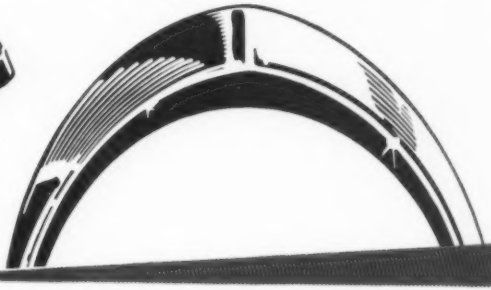
metal finishing

PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, METAL SPRAYING and all METAL FINISHING PROCESSES.

Vol. 7 No. 78 (New series) JUNE, 1951

NEW N2E Semi-Bright Nickel

combines with 66 Bright Nickel



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Sodium Citrate	✓	✓		✓		✓			
Ammonium Citrate	✓	✓	✓	✓					
Gluconic Acid	✓	✓	✓	✓					
Glucono Delta Lactone	✓	✓	✓	✓					
Sodium Gluconate	✓	✓		✓					
Ammonium Oxalate	✓	✓		✓					
Ferric Ammonium Oxalate									✓
Tartaric Acid	✓		✓	✓				✓	
Tartar Emetic				✓					
Rochelle Salt			✓	✓					
Cream of Tartar	✓			✓					

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Nontoxic, mild, yet chemically active against scale and tarnish. Used extensively in the formulation of general metal cleaners and polishes, particularly household products.

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CANNING

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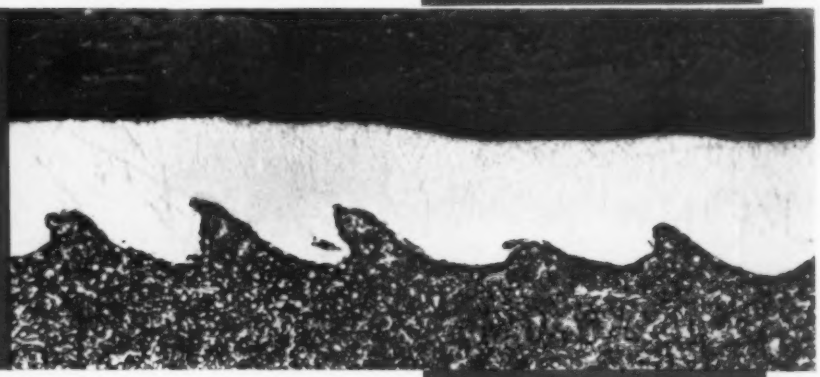
NICKEL PLATING SOLUTION

The new semi-bright solution for

SUPERLATIVE LEVELLING and deposits of OUTSTANDING CORROSION RESISTANCE

Simple low cost maintenance with a single addition agent



Microsection (x 750) 296 nickel deposit on rough surface showing remarkable levelling properties

Nickel plating solution 296 is ideal as an undercoat for DUPLEX NICKEL and is also effective as a single nickel coating prior to chrome where maximum resistance to corrosion is required.

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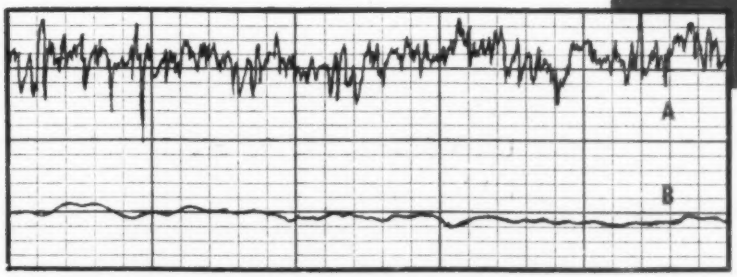

"TALYSURF" traces

A. Steel finished with 240 grit Aloxite

B. Same surface plated with 0.0012" deposit of 296 nickel

For further particulars ask for Canning News Sheet No. 15A

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metal finishing journal

June, 1961 — AN INDUSTRIAL NEWSPAPERS PUBLICATION — Vol. 7, No. 78 (New Series)

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Contents

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IRREGULAR PAGINATION

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A LIVELY FORUM

HOWEVER great the virtues may be of any particular product, if those for whose use it was designed are unaware of what it can do for them or even of its availability, it cannot serve its purpose and find a market. Today, however, by an exaggerated extension of this sound principle the message is tending to assume greater importance than the reality. There is available today a wide range of products serving greatly differing purposes, whose technical excellence is such that any claims to superiority are purely marginal, and the volume of sales depends almost entirely on the effort put into sales promotion rather than on the substantiation of claims made for the superiority of the product over " Brand X."

It should however be possible to make some distinction between the marketing of a washing product, or a shampoo or a soft drink to a largely unthinking mass market whose choice of product can be converted almost into a conditioned reflex, and the selling of plant, machinery and materials to industry whose buying staff should be less susceptible to subjective influences.

Almost all the suppliers to the metal-finishing industry make use of highly skilled technical sales staff to convey their message to actual and potential customers ; many of them use the advertising pages of the technical press and sometimes the national press to keep their name before their public. Indeed some of the names in this way have become industrial household words.

Yet, it was deemed by some well informed members of the industry, that still further specialized effort was called for to promote communications between supplier and customer and some ten years ago the decision was taken to stage an exhibition entirely devoted to the finishing industry. Support for this from both consumers and suppliers was restrained and the venture was not repeated.

In the years since that early attempt, the various technological organizations in the finishing field, and notably the Institute of Metal Finishing, have succeeded in giving a much greater sense of corporate entity to the industry, and the concept of personal contact has been fostered and enhanced. It was against this background of growing corporate sense that in recent years a number of exhibitions, ranging from the purely scientific to the largely commercial, have been staged in the field of corrosion prevention, a field which inevitably embraces a good deal of finishing technology.

It may well have been the support and interest evoked by these that led to the sponsoring of a further venture this year at promoting an exhibition specifically devoted to industrial finishes. Whatever the motive, and in spite of the prognostications of those who forsaw a repetition of the lukewarm reception accorded to the earlier endeavour, the exhibition, which was held at Earls Court for 4 days last month, turned out to be a lively occasion supported by some 120 exhibitors and attracting an interesting attendance throughout the period.

It was very obvious that many buyers of finishing equipment and materials welcomed the opportunity of discussing their production problems with the suppliers whose function it is to solve them. This is after all not a particularly surprising state of affairs. What perhaps does need explanation is why it is necessary to hold an exhibition with all the attendant costs and difficulties in order to achieve this laudable end. Perhaps the organizations whose purpose it is to provide the facilities for such encounters will find here material for a reappraisal of the methods they have chosen for discharging their responsibilities.

Talking Points

by " PLATELAYER "

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

SAME AGAIN !

NOW that the last Annual Converence of the Institute of Metal Finishing is only a memory, it might not be a bad thing for the Council to give some consideration to the question of its future. The pattern has become so established and seemingly immutable, that it is a wonder that it still retains its attraction. The round of cavernous, mediocre Victorian hotels, the continuous somewhat forced bonhommie, and the repetitive cocktail assemblies must surely pall one day. The same old faces, a little older each year, greet one another in the same old places, and the current crop of papers seems to differ so little from the last one. Occasionally something stirs in the wilderness like Dr. Abner Brenner's brilliant Hothersall Memorial Lecture, but for the rest — oblivion.

Already, the 1962 meeting is being planned — although the word " planned " is perhaps a misnomer. Is it too late to introduce a new approach that will stir the imagination even slightly ?

Which brings me to the subject of the Industrial Finishes Exhibition. Most people would agree that this was a useful and lively show, but to time it to follow straight on after the I.M.F. Conference was hardly the best thing to do. A little co-operation is called for here in the future.

TOUGH ON INVESTORS

IN a reference to the recent Mining and Metallurgical Congress in South Africa, the Investors' Chronicle comments :

> " On the subject of shaft sinking, many investors are completely indifferent whether a shaft is circular, square, or any other shape. The matter is of great significance. A circular shaft offers less resistance to the passage of air, a factor which can save thousands of pounds a year."

This kind of thing must come as a considerable shock to the ignorant investor whose decision as to whether or not to buy shares in a gold mine is determined by such minor considerations as the future price of gold and the stability of the local regime. I am quite sure the shape of the shaft never comes into his calculations.

Perhaps Chairmen of companies in other fields had better revise their speeches and include such pertinent items of information as the brand of paint used on their products and the number of coats applied. Clearly, a company using two coats of Brand X may be spending thousands of pounds a year less than one applying three coats of Brand Y, a fact of which the shareholders may be blessedly unaware. As to the problem facing the poor investor who tries to assess the cost per thousand ampere hours of the bright nickel process his company uses as against the one operated by its main competitor, the imagination boggles. For my part, investment looks like becoming altogether too technical a matter, and I am staying with my National Saving Certificates. They have no shafts !

FAIR TRADE

THE opening of the British Trade Fair in Moscow is a momentous event, and will probably do something to stimulate Soviet interest in British goods, especially in the case of raw materials and capital equipment. Where consumer goods are concerned, however, exhibitors are likely to be disappointed. Although such products are receiving an increasing amount of attention so far as production is concerned, undue preoccupation with them is regarded as a very low grade activity indeed.

In a recent book, Joseph Novak quotes from an interesting interview he had with the chief designer of a Russian camera plant, who said :

> " Our Soviet technology has run on two tracks. On one track we push technical progress in nuclear energy, chemistry, applied mathematics (computers and calculators) and so forth, which are revolutionary in technique. On the other track, we simply adapt from others. For example, in producing cameras, cars, radio sets, refrigerators, television sets and such items, we adapt products which have been tested and are considered the best in Western Europe and the United States.
>
> Just think how much human energy is wasted in countries like the U.S.A. where hundreds of companies, competing factories, construction firms, inventors and scientists work for the sole purpose of bringing our new models of household appliances. Out of their furious rat race of talent and creative brain power, every now and then they produce the perfect refrigerator or the ideal fountain pen. Then we take over the design and mass produce it."

If this is true, the Trade Fair should certainly help !

A Report of the Annual Conference of the INSTITUTE OF METAL FINISHING

NEW ground was again broken this year by the decision of the Institute of Metal Finishing to hold their annual conference in Llandudno, and the registration of over 400 delegates, the great majority of whom attended the full term of the conference, constituted a very satisfactory attendance.

The conference was formally opened on the morning of Wednesday, May 3, by the Chairman of the Llandudno Urban District Council, who was received by the president of the Institute, Mr. A. A. B. Harvey, supported by the immediate past president, Dr. T. P. Hoar, and the Honorary Secretary, Dr. S. Wernick. On the evening of that day the delegates and their ladies were entertained at a reception and dance given by the Chairman and Members of Llandudno Urban District Council at the Cafe Royal.

The social activities of the conference culminated on the night of Friday, May 5, with the conference dinner and dance, held at the Winter Garden.

During the conference, as might be imagined, tours to the beauty spots of North Wales were arranged for the ladies, and for members there was a visit to the works of A.E.I. (Hotpoint) Ltd.

A highlight of the conference was the Seventh Hothersall Memorial Lecture, presented at the Grand Hotel on the evening of May 4, by the eminent electrochemist Dr. Abner Brenner, chief of the electrodeposition section of the U.S. National Bureau of Standards.

The usual display of technical exhibits was staged, these being as in former years illustrative of the themes of the papers presented at the sessions.

Reference must, of course, be made to the painstaking work of the social sub-committee, to the technical sub-committee who organized the effective programme of sixteen papers, four of which were contributed and read by authors from overseas, to the session organizer who had the responsibility of ensuring the smooth administration of the technical session and to the untiring efforts of the small band of workers at the I.M.F. office.

In the pages which follow we present brief abstracts of the technical papers presented at the first Technical Session on the morning of the first day, together with a preliminary report of the discussion which followed their presentation, interspersed with some random studies by our roving cameraman of some of the delegates in a variety of moods. Reports of subsequent sessions will be published in future issues of this Journal. The full text of the papers has been, and is being, published, together with the authoritative version of the discussion, in the Transactions of the Institute of Metal Finishing.

THE INFLUENCE OF ADDITION AGENTS ON THE COMPOSITION OF NICKEL DEPOSITS.

by A. H. Du Rose*

THIS paper is a review of investigations carried on by or for the author's company over the past eleven years. It is primarily concerned with the commonly designated organic-type bright nickel solutions and deposits from them. Analyses of carbon, sulphur and nitrogen in the nickel deposits and cathode polarization in the solutions were also studied.

By organic type is meant the addition agent combination of a sulpho-oxygen compound used in relatively high concentration. It is shown that the cathode polarization is increased by the brightener and that this can account for a more complete reduction in the sulphur in the sulpho-oxygen organic control agent. The control agent contributes sulphur to the deposit but no significant amount of carbon, the sulphur being reduced and cleaved from the control of the molecule.

*Harshaw Chemical Co., U.S.A.

The nitro-containing organic brightener contributes both carbon and nitrogen to the deposit. The rate of increase in sulphur content of the deposit with respect to an increase in control-agent concentration is inversely proportional to the control-agent concentration.

No attempt has been made to explain the kinetics of polarization, nor to distinguish between hydrogen and nickel overvoltage. Polarization used is that increase in potential as measured by several methods.

The results reported in the paper on nickel deposition are an accumulation of several scattered research projects among which are the following:

(a) Work by H. Leidheiser on levelling, polarization and crystal structure. A Luggin tubulus was used in the potential measurements.

(b) Polarization studies using a calomel electrode placed at a definite short distance from the cathode, and the IR drop correction made by a method similar to that of Shreir and Smith.

(c) Polarization studies using an electronic commutator instrument designed and built by E. Yeager and his colleagues.

(d) Carbon and sulphur analyses of various

The president (Mr. A. A. B. Harvey) and the hon. secretary (Dr. S. Wernick) are here shown with some of the overseas delegates attending the annual conference of the Institute of Metal Finishing.

Mr. R. T. F. McManus (Harshaw Chemicals Ltd.) Chairman, IMF Social Committee, Mrs. C. Sieff (I.M.F. office), Mr. R. F. Gear (Engelhard Industries Ltd., Baker Platinum Division), Mr. H. Cann (W. Canning and Co. Ltd.) and Mrs. E. Last (I.M.F. office) at work on Conference organization.

deposits by combustion methods and nitrogen, hydrogen and oxygen by the vacuum-fusion mass spectrometer.

(e) Many of the deposits were inspected by electron microscope and diffraction and by X-ray diffraction.

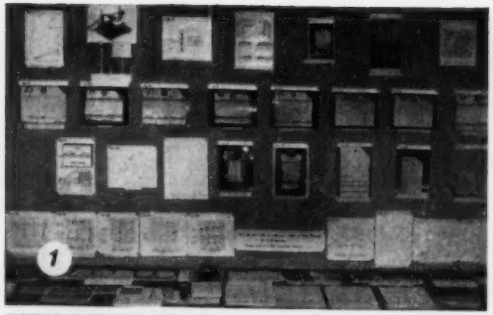
In general, the author's work and that of others, show that Watts nickel under conditions as used in the paper, has a (100) preferred orientation. The addition of control agents of the type studied decrease the crystallite size of the deposit somewhat and the orientation remains (100). The further addition of a polarizer usually results in a random structure and a greater decrease in crystal size. This holds true whether or not the resulting deposit is bright. However in some cases with the combination of control agent and brightening or non-brightening polarizer, some orientation has been observed.

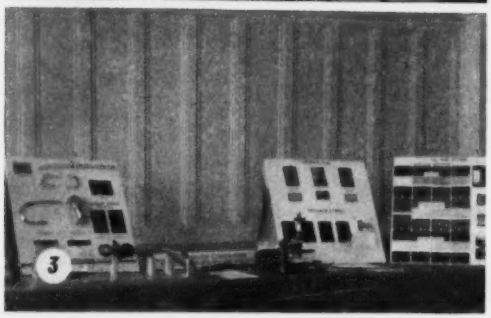
DISCUSSION

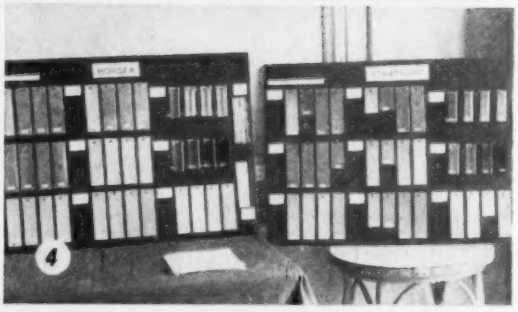
DR. J. EDWARDS (B.N.F.M.R.A.) said that it was the composition of nickel deposit in the presence of various organic substances that most interested him. Speaking of the Tafel equations, the author had said that levelling nickel solutions had high "a" values and low "b" values compared with non-levelling. He had concluded that the difference in levelling power between such solutions should thus become less with increasing current density, and that the throwing power of levelling solutions should not be as good as that of non-levelling. Both of these expectations were generally realized, but the argument was nevertheless false, certainly incomplete, since it neglected the rate of change of polarization with concentration, or diffusion rate, of the addition agent, which was of prime importance for levelling. Moreover, not all levelling solutions had low "b" values. Dr. Watson had shown that some levelling agents could, in fact, produce improved throwing power.

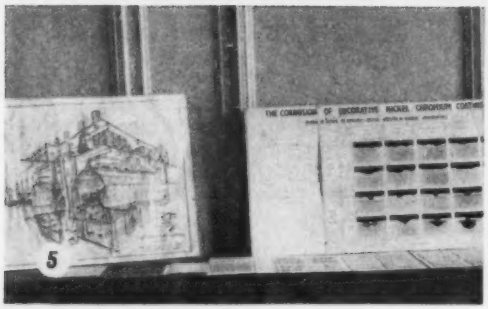
He sympathised with Mr. Du Rose's difficulties with regard to the reproducibility of chemical analysis of deposits. The analytical techniques might be partly at fault but he was sure that an imperfect control of plating conditions, solution purity and composition was the more important source of inconsistency. The difficulties of maintaining constant conditions were accentuated by the need to produce fairly large samples for chemical analysis. If radio-tracer techniques were appropriate and could be used instead of chemical analysis some of the difficulties disappeared and it was often possible to obtain good reproducibility. For absolute values, of course, one was still often dependent on chemical analysis. However, in the case of thiourea, for example, sulphur atoms were strongly adsorbed and their rate of incorporation in the deposit governed by the rate of diffusion of thiourea molecules. It was not too difficult then

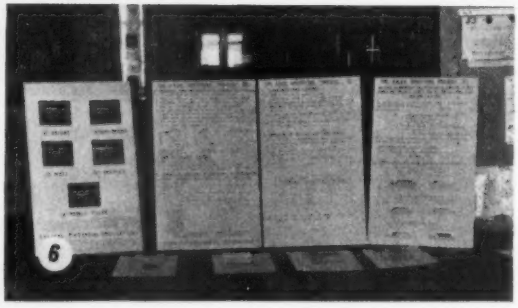
This group includes Mr. J. W. Hill (B and T. Anodising Co. Ltd.) Mr. J. M. Kape (Aluminium Laboratories Ltd.), Mr. H. A. Manning (Holmes Plating Co. Ltd.), Mr. J. M. Shepherd (Malden Plating Works) and Mr. E. C. Walls (Grauer and Weil Ltd.).

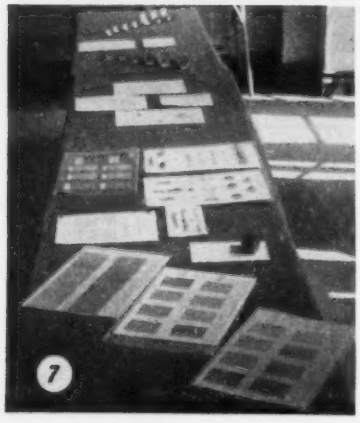












As in previous years a display of technical exhibits illustrating the subject matter of some of the papers was staged under the direction of Mr. E Spencer-Timms. Those shown in the photographs above related to the following papers :

(1) *" The Use and Value of Laboratory Tests of the Durability of Paint Coatings," by J. A. W. Van Laar (N. V. Philips' Gloeilampenfabrieken).*

(2) *" Influence of Prelating Processes on the Porosity of Electrodeposits on Steel," by M. Clarke and S. C. Britton (Tin Research Institute).*

(3) *" Selection of Finishes for Protection and Decoration in the Motor Industry," by R. J. Brown (British Motor Corporation Ltd.).*

(4) *" One-year Exposure Tests on Anodized Aluminium," by J. A. Whittaker and J. M. Kape (Aluminium Laboratories Ltd.).*

(5) *" The Corrosion of Decorative Nickel + Chromium Coatings," by G. N. Flint and S. H. Melbourne (International Nickel Co. (Mond) Ltd.).*

(6) *" Influence of the Composition and Heat Treatment of Carbon and Low-Alloy Steels upon Response to the A.R.D.E. Smoothing Process " by W. A. Marshall, V. J. Saunders and R. A. F. Hammond (A.R.D.E.)*

(7) *" Selection of Finishes for Communications Equipment," by W. Marchand (Standard Telephones and Cables Ltd.).*

Mrs. M. L. Alkan, Mrs. L. Burton (Despo Chemicals Ltd.) and Mr. E. A. Ollard (Atlas Plating Works Ltd.).

to reproduce values of sulphur content. Carbon content was a different matter. Only a small proportion of the carbon in the thiourea molecules which reached the cathode surface were actually incorporated in the deposit. It was not surprising, then, that the carbon content was rather variable, presumably being very sensitive to small departures from the nominally constant conditions.

In Table III it was shown that there was an increase in carbon and sulphur contents due to the combination of control agent and polarizer, making a strong case for the existence of a synergistic effect. Nevertheless, the variability of some of the results in the table were disconcerting and must raise some doubts about the validity of any of the conclusions drawn. He was glad, therefore, to be able to offer some supporting evidence, using saccharin labelled with sulphur-33. A deposit from a solution containing rather less than 2 gm. per l. of saccharin of very low specific activity gave a count of 32 c.p.m. above background. The addition of 5 p.p.m. of fuchsin gave 106 c.p.m.; 10 p.p.m. gave 158 c.p.m.; 10 p.p.m. gave 193 c.p.m.; 10^{-4} M gave 260 c.p.m.; 2×10^{-4} M gave 340 c.p.m. and 5×10^{-4} M produced a streaky deposit which was not suitable for counting.

The author had suggested that the synergistic effect was due to an increase in polarization produced by the brightener, which caused more effective reduction of the control agent ; but it was shown in the paper that at low concentrations fuchsin reduced polarization, and it was pointed out that this was usually in the presence of a control agent at the concentration of fuchsin used commercially. Furthermore, from his own work it seemed that some polarizers could reduce incorporation of sulphur from control agents, perhaps because they were very strongly adsorbed and could exert a blocking effect.

The influence on one another of brighteners and control agents was therefore even more complex than appeared at first sight, and he was afraid that the interpretation of the interesting phenomenon to which Mr. Du Rose had drawn attention must await the results of further work.

Mr. H. J. W. Vardon (The Geigy Co. Ltd.), Mr. R. Warburton (A.E.I. Hotpoint Ltd.), Mr. S. C. Britton (Tin Research Institute), Mr. G. C. Carr (A.E.I. Hotpoint Ltd.) and Mr. W. Marchand (Standard Telephones and Cables Ltd.).

Mr. A. J. L. Nash and Mr. G. H. Turner (R. Cruikshank Ltd.), Mr. G. A. Moodie (R. Cruikshank Ltd.), and Mr. F. W. Anderson (Lea Manufacturing Co. of England Ltd.).

MR. J. M. SPRAGUE (Consulting Electrochemist) said that Mr. Du Rose's attempt to classify some of the terms used was very helpful in view of the existing confusion. However, he had not mentioned levelling agents, in this respect. It was true that in one part of the paper he had referred to them and had said that they were similar in action and differed more in degree than anything else. However, it seemed that in many cases they could be distinguished fairly clearly. It would be of interest to learn where the author would put his levelling agents in his actual classification.

The range of sulphur and carbon content found in the Watts deposit was so wide that he would ask whether it was quite sound to speak in terms of an average figure.

DR. T. P. HOAR (University of Cambridge) said that his own department had been studying the action not only of brightener agents but stress reducing agents, and the results obtained matched very well much that had been reported by the author. They had turned away from addition agents to study the nickel process itself and had found it exceedingly complex. The process was undoubtedly accelerated and decelerated by various things adsorbed.

He asked what was the structure of the ordinary double layer as it was set up on nickel in a pure solution containing no addition agents at all? There was little doubt that sulphate ions had an effect on this, and if both a nickel chloride solution and a nickel sulphate solution were polarized, a different result was obtained in each case. In a Watts solution there was a fairly complex mixture of anions and there was not much likelihood of obtaining anything particularly meaningful from the theoretical point of view. The only way to do that was to take a solution containing a small amount of nickel and a large amount of sodium sulphate, for instance, and then the experiment became removed from the realm of ordinary electroplating conditions.

The various effects of addition agents were not always recognized, and this had to be kept in mind.

It had been suggested that sulphonates were incorporated in the deposit and degraded dislocations in such a way as to turn them from outward-pointing to inward-pointing, changing the stress from tensile to compressive, and he thought that this did happen.

MR. J. CHADWICK (Joseph Lucas Ltd.) referred to the author's concluding paragraph, in which he had said that brightness was associated with absence of surface projections. He would like clarification of this, so that it would not be inferred equally that lack of brightness was always due to the presence of surface projections. He wondered whether the author, in referring to "brightness," was thinking more in terms of specular reflectivity than actual brightness.

Author's Reply

MR. DU ROSE, in reply, said that, having in mind the results obtained he would adhere to what he had said about the "a" and "b" values. He might well be proven wrong later : it could be that it had something to do with the method of determining polarization. It would be noticed that they had used two methods, the commutator and the capillary, and that differences had been revealed. One of these could be accounted for by the dissimilar temperature of the solution, but the other could not be accounted for in that way. In general it had been found that any solution which had good levelling seemed to have a little less macro throwing power. In commercial practice it was very unimportant and one could only

determine the difference in nickel throwing power by laboratory techniques. Even then it was rather small.

Dr. Edwards had mentioned reducing polarizers. He was not quite certain what was meant by this: perhaps they should not be then termed polarizers, and he would question whether they would be brighteners in the sense used in the paper. The latter, of course, left many questions unanswered. He hoped that others would be moved to take them up, and determine some of the finer issues.

There were, of course, all kinds of surface projections, from the microscopic to the very large. He could not quite understand Mr. Chadwick here. The last paragraph in the paper referred to the other two explanations customarily offered for deposits becoming bright. The paper had tried to show that essentially the brightness was due to what one might call "micro-levelling."

LEVELLING ACTION DURING ELECTRODEPOSITION IN NICKEL AND ACID-COPPER SOLUTIONS

by S. A. Watson*

THE work described in this paper is an extension of an investigation of the mechanism of levelling reported in 1957 by Watson and Edwards. To test further the validity of the ideas then presented and to allow them to be extended, a considerable amount of further information was collected and correlated. As a background to this report of the later work, a condensed account is given of the position up to and including the first paper.

The effects, on levelling, of variations in agitation, *p*H and temperature are shown to be in accord with a hypothesis of levelling action put forward earlier. Measurements of levelling power on microgroove record masters are found to indicate satisfactorily the relative levelling action to be expected on commercially abraded surfaces. Cathode-potential measurements have been made with 60 addition agents in nickel solutions and with 30 in acid-copper solutions, and where application of the hypothesis to the potential values promised strong levelling action, actual levelling powers were measured. In all such cases high values were obtained. A method is described which permits rapid identification of levelling agents, by means of a simple cathode-potential change ΔE_m. It is also shown that a non-levelling agent such as saccharin can modify the behaviour of a levelling agent.

Levelling power was measured at a number of concentrations of addition agent other conditions being kept constant. Results for the standard nickel solution containing isoquinoline, magenta chloral hydrate, succinonitrile and mixtures of thiourea plus saccharin and succinonitrile plus saccharin are tabulated in the paper. Isoquinoline and magenta gave dull or poor-quality deposits and in these instances no quantitative measurements of levelling power were made.

Levelling power was determined in a solution containing coumarin at a concentration of 0.0002M: *p*H, temperature and rate of agitation were independently varied. The results show that increasing the rate of agitation or raising the temperature increases the levelling power of this solution.

A curve of levelling power plotted against the *p*H of the solution shows that levelling power increases as *p*H is raised, apparently reaching a maximum somewhere between *p*H 4.00 and *p*H 5.64, and then falling.

To determine whether surface roughness produced by abrading with emery bobs were reproducible, some preliminary measurements were made on steel surfaces variously abraded.

The results of Talysurf measurements, expressed as centre-line-average roughness show that surface roughness produced by bobbing depends upon the amount of use of the bob, and upon unknown factors, at least as much as it depends upon the grade of abrasive used to coat the bob.

A property of addition agents which might be expected to influence both the degree of adsorption and the effect on cathode potential of adsorbed molecules is the dipole moment. However, no correlation has been found in the paper between dipole moment and effect on cathode potential. It will be noted that the dipole moments of urea and thiourea, which have entirely different effects on potential, are closely similar.

Mr. J. N. T. Adcock (I.C.I. Ltd. (Paints Division)) and Dr. F. A. Champion (British Aluminium Co. Ltd.).

*International Nickel Co. (Mond) Ltd.

It seems from the paper that a major factor in relation to the effect of addition agent on cathode potential is its molecular structure: thus, the potential data for *sym*-diethyl thiourea, thioacetamide and thiosemicarbazide in nickel solution show the same trends as those for thiourea.

It appears that a fall in cathode potential is produced only by substances which are adsorbed on a freshly deposited nickel surface and incorporated in the deposit or otherwise consumed at the cathode surface. Ease of adsorption must therefore play a large part in determining the effect of the substances on potential, and might, for example, be involved in the diminished effect of thiourea or succinonitrile on cathode potential resulting from addition of saccharin to the solution. Further progress would appear to require a careful study of adsorption of addition agents during plating.

DISCUSSION

MR. T. E. SUCH (W. Canning and Co. Ltd.) said that Dr. Watson had expanded on the pioneering work that he and Dr. Edwards had done on the mechanism of levelling, and had presented in 1957.

The author's comprehensive work had proved that, if an organic compound was to give a levelling action from a nickel or copper solution it must lower the cathode potential by a substantial amount; but the question still remained—why should these particular compounds lower the potential? He felt this was now the most important point. It was not just the capacity of some organics to be adsorbed on a growing nickel surface that resulted in this property. Secondary brighteners, such as saccharin or naphthalene sulphonic acids, were adsorbed at the cathode, or at least part of their molecule was so adsorbed, but they did not greatly affect the cathode potential and only gave very slight levelling. The difference might lie in the capacity of these organic levellers to be readily reduced at the cathode. However, secondary brighteners, like sulphonic acids, suffered desulphonation at the cathode, which led to occlusion of sulphur with little carbon. As this desulphonation involved the addition of electrons, it could be looked upon as a form of reduction and so perhaps even the ease of its cathodic reduction was not the sole criterion for an organic compound to be a leveller.

While classifications such as those given on page 154 were of interest and potential help in interpreting the results obtained, they must be used with care. For example, he took it that the alcohols in class B.I. did not include acetylenic types. Also, he presumed that the non-reducible groups of the unsaturated alcohols referred to in C.1. were their hydroxyl groups, for the triple bonds of acetylenic alcohols were easily hydrogenated at the cathode, which was surely reduction, and, of course, nickel was a recognized catalyst for the hydrogenation of acetylenic and ethylenic bonds, as well as other unsaturated systems.

He would suggest one or two additions that might have been made to the paper. On p. 151, Table VII gave cathode potentials in nickel solutions containing thiourea and saccharin, the purpose being to show what effect saccharin had on the potentials produced by thioureas. Unfortunately there was no similar table for thiourea by itself and so no such comparison could be made. He had been forced to turn to a graph in Dr. Watson's first joint paper to find figures for thiourea alone. This gave somewhat different values for the same concentrations of thiourea, but one was not told whether the differences were significant or not. Why had the author chosen these particular ratios of thiourea and succinonitrile with saccharin ?

Turning to p. 149 and Table IV, it would have been more enlightening if Dr. Watson had only changed one variable at a time and kept the thickness of nickel constant. He would like to see the effect of current density alone on the levelling given by these various solutions, and this could not be ascertained from the table. He could not reconcile the figures of 17 and 66 per cent levelling given by the semi-bright nickel for plating at 20 and 40 amp. per sq. ft. respectively. Under the conditions stated he felt that, while the 66 per cent levelling was correct, the 17 per cent value was too low. He would have expected a figure of about 40 per cent to be obtained.

"Average Thickness"

MR. A. H. DUROSE (Harshaw Chemical Co.), said that the author had taken as a measure of levelling the difference between the depths of groove before and after plating, divided by the average thickness of the deposit. What was meant by "average thickness," and how was it determined ? It was stated that the data showed apparent agreement between levelling of grooves and on abraded surfaces. He had difficulty in finding enough comparisons from which to draw a conclusion. At 20 amp. per sq. ft. the data for the two chloral concentrations, and dull nickel, did not follow the same sequence as the groove levelling power. At 40 and 80 amp. per sq. ft. data for only one four-hour concentration were given. In the discussion the groove levelling for diethyl thiourea was given as 0.9. In the Watson and Edwards paper the only value he could find was about 0.25 for this compound at 0.0015 molar. If 0.25 was used a poor correlation would seem to have been obtained for group levelling versus abraded surface levelling. Should not the last value in Table IV be "9" instead of "1."

DR. T. P. HOAR (University of Cambridge) said

that he would like clarification of the following observation : " It is possible that a substance might effect cathode potential without being incorporated in the deposit or otherwise consumed at the cathode surface, but such a substance, because it would not be removed from the layer of solution adjacent to the cathode, could not function as a levelling agent, although a theoretical levelling power could be calculated for it. Since, however, there is good agreement between the theoretical and experimental levelling curves in all the cases examined, it seems that consumption of the polarizing agent is always a concomitant of the lowering of cathode potential." He was sure that in many cases it was possible to lower cathode potential during deposition by substances which were not incorporated either as themselves or as their decomposition products. One could certainly alter the potential of mercury electrodes by adsorption without getting incorporation. In common with Mr. Such, he found the tabulation of materials somewhat arbitrary. For example, only one or two short-chain amines had been used, but if the experiments were done with longer chain amines, such as the octyl-amines, it would be found that an enormous effect on polarization was proeuced. However, he doubted whether they would be incorporated in the deposits except in the minutest amounts.

Generally speaking, arguing from analogy was dangerous. At the bottom of p. 154 the author said " Reducibility at a polarographic mercury electrode thus appears to be an empirical means of distinguishing substances which affect cathode potential in nickel solution from those which do not." He did not think this would be found to be general. Many substances were not reduced at mercury cathodes, such as long-chain amines, which would be found to affect greatly the cathode potential. The author continued : " It appears that a fall in cathode potential is produced only by substances which are adsorbed on a freshly deposited nickel surface . . . " With this he would agree, but the author went on : " . . . and incorporated in the deposit." There were many cases where that was not true. He would like an explanation of these statements. The paper was a valuable addition to the earlier one from the author and Dr. Edwards on the theory of levelling. However, he did not think that sufficient was yet known about the cathode potential and incorporation to be quite so general.

DR. D. N. LAYTON (Ionic Plating Co. Ltd.,) asked the author how reproducible were his measurements of levelling. A source of continual worry to those who had to use such results in practice was the fact that the experimental scatter was so very large. The author had mentioned one very non-reproducible result — the surface finish obtained by abrasion, especial under normal production methods. This was undoubtedly very common, but high scatter in levelling measurements were also common.

He would like to mention a technique that had been found helpful in trying to assess the value of different solutions. If one wanted to use a solution in production and avail oneself of its levelling properties it was necessary to have good levelling over a wide range of surface finish. It was not possible to guarantee that in the polishing shop the surface finish would be within a narrow range.

By plotting levelling against initial roughness a great deal of scatter was obtained in the individual results, but if one drew a slightly different graph and plotted final roughness against initial roughness it was possible without much difficulty to plot a line which fitted the points fairly well and showed a trend. The shape would depend on the particular solution used. By taking various values of initial roughness and reading off figures of final roughness it was possible to calculate the levelling at different values of the initial roughness. It was then possible to plot another graph of levelling versus initial roughness which had varying shapes according to the solution used. It was a very easy and clear way of distinguishing the characteristics of different solutions. Some were of a very marked kind, and what was being sought was a solution with a wide plateau — high levelling power over a wide range of initial roughness.

Author's Reply

DR. S. A. WATSON, in reply, said that it was true that there were no tabulated data in the paper for thiourea as there was for thiourea + saccharin. He had had to make a choice from some thirty tables, but all were available in the thesis on this work, at London University. The ratios had been chosen rather arbitrarily.

He had been asked why, in the experiments with steel cathodes, the same timings had been used at differing current densities. The aim had been to get some idea of what would happen on a commercial article, where one had a shaped surface. It would be interesting to maintain current densities at these values and alter plating times as suggested.

" Average thickness of deposit " had been obtained by using a flat surface, sectioning, taking a measurement, and converting, to what one would get on a piece of microgroove. It was possible to multiply by the ratio of the true to the apparent area. One one chloral hydrate composition was given because, on the results, the levelling powers were not very different in the two concentrations.

He had re-drawn the earlier graph of Dr. Edwards and himself in the light of further work. Fig. 10 showed a large number of thiourea derivatives.

The curves were all very steep. The provisional curves in the earlier paper had been dotted. It could vary between 0.6 and 1.2 and still give satisfactory results. The last figure in Table IV should indeed be 9 instead of 1.

Dr. Hoar had asked how he could calculate a theoretical levelling power for a substance which gave polarization but was not adsorbed. Provided its effect varied with concentration and current density one would expect to be able to calculate a theoretical levelling power in the usual way. Their investigations suggested that substances which affected polarization were adsorbed or consumed. Consumption was important. Dr. Hoar had also accused him of saying that these things were incorporated in the deposit but his point was that they were incorporated or otherwise consumed.

They had not looked at octyl-amines and obviously never would. They had put down purely an empirical generalization which, if it provided any help whatever, would have been worth-while.

Levelling power was reasonably reproducible because by examining the parameter as a concentration of levelling agent one got a smooth curve, but if one meant levelling action on the pieces of abraded steel, this was not at all reproducible. In the paper he had made the point that this was an argument for using a standard surface of reproducible form, such as a microgroove. The technique that Dr. Layton suggested seemed valuable and he would examine it in detail before commencing further.

THE CORROSION OF DECORATIVE NICKEL PLUS CHROMIUM COATINGS: A METALLOGRAPHIC AND POTENTIAL STUDY

by G. N. Flint* and S. H. Melbourne*

THE paper compares the morphology of pits in decorative nickel plus chromium coatings resulting from service in an industrial atmosphere with that of pits produced in accelerated corrosion tests. In the three accelerated tests examined and in the early stages of service, corrosion was frequently characterized by formation of hemispherically shaped pits in the nickel layer ; these occurred at discontinuities in the chromium top coat.

In the later stages of service corrosion, after several years, exposure pits were more often of irregular shape.

In copper plus nickel plus chromium coatings, none of the accelerated tests gave close reproduction of the type of pit produced by corrosion in service. In double-layer nickel plus chromium, however, the type of pitting experienced in service was reasonably well reproduced by the acetic-acid/salt-spray and the Corrodkote tests, but not by the SO_2 test.

The nature of the pits formed in the early stages of service corrosion confirms the general view that breakdown of nickel plus chromium coatings at cracks in the chromium top-coat, thus localizing corrosion of the nickel undercoat and causing undermining of the chromium layer. In these circumstances, the formation of an hemispherical pit in the nickel layer would not be unexpected, since the chromium surface acts as the only effective cathode, and substantially all the corrosion current would oblige to pass through the gap in the chromium coating.

Where the protective coating consisted of three layers having different electrochemical characteristics, the accelerated corrosion tests did not always reproduce the same type of pitting as that occurring in service. For example, in copper plus nickel plus chromium coatings, under service conditions the copper layer most frequently corroded in preference to the nickel, whereas in the accelerated corrosion tests it was the nickel layer which suffered preferential attack.

Preferential attack of the nickel was most marked in the SO_2 test and least in the Corrodkote test ; the effect of the acetic-acid/salt-spray test was, in this respect intermediate. This order is the same as that found for the difference in potential between copper and bright nickel in the respective electrolytes over the greater part of the current density range examined.

The anode-polarization measurements are in agreement with the metallographic observations. In the acetic-acid/salt-spray and the Corrodekote media, the semi-bright nickel was distinctly more noble than the bright nickel, but in the SO_2 solution there was little difference in either the potential or the polarization characteristics of the two types of nickel.

*International Nickel Co. (Mond) Ltd.

DISCUSSION

MR. D. R. NEWMAN (Electro-Chemical Engineering Co. Ltd.), said that the particular value of the paper was the measure of confidence that it gave in the accelerated corrosion tests discussed — the salt spray and the Corrodkote. But had sufficient samples from cars been examined to ensure that the mechanism of corrosion found for dual layer nickel was applicable in the majority of cases or, in practice, were some completely hemispherical types encountered ?

The paper helped, too, the critical discussion of the sulphur dioxide test — the Kesternek test used widely in Germany, and the B.N.F. test in this country — and showed that it was not a

Mr. W. R. C. James (The Pyrene Co. Ltd.) and Mr. L. T. Lake (The Pyrene Co. Ltd.).

particularly good test owing to chemical attack on metal. This meant that such tests were really porosity tests for chromium deposit. Also, in the case of, say, dual layer for finely cracked chromium, which seemed to give exceptionally good results in the Corrodkote and acetic acid salt-spray tests and certainly in outdoor exposure of nickel-plated steel and copper-plated die castings, sulphur dioxide-containing tests detected the porosity of the finely cracked chromium layer and indicated that a very poor result would be obtained. This was, to some extent, a condemnation of the present sulphur-dioxide tests but he did not think that it should be a condemnation of sulphur dioxide as such. The latter undoubtedly did occur in industrial and city atmospheres and for that reason he would like to hear the author's views on the possibility of including either sulphur dioxide or sulphates in something like the Corrodkote or accelerated salt-spray test.

He would like the authors' views on whether it was the absence of sulphur in semi-bright nickels or the columnar structure that was important. In the case of one or two fairly large installations in the United States which used dual layer nickel the under layer of semi-bright nickel did contain sulphur and had an undoubted columnar structure.

MR. T. E. SUCH (W. Canning and Co. Ltd.), said that the authors were correct in saying that all tests now in common use were developed empirically and were only suitable as sorting tests. He would himself prefer to call them ' production inspection tools.'

It was unfair to expect that the same tests, which gave rates of corrosion 500 to 1,000 times greater than occurred in service, should also reproduce the same mechanism of corrosion. As the authors said, " on outdoor exposure insoluble corrosion products such as basic sulphates are formed in the pits and these tend to stifle further attack." It was clearly evident, he said, that in tests such as the Corrodkote, which ate through 0.001 in. of nickel in 20 hours, only soluble corrosion products could be formed. Therefore, he would ask the authors to consider including a chemical study of the corrosion products formed together with their metallographic and potential work.

Roof Tests

Roof tests had been critized in the past for corroding plated articles far more quickly than in road service. This they did, but only by a factor of 5 to 10, not 1,000, and he felt that this was far more likely to reproduce the true mechanism of corrosion, by producing natural corrosion products. than were the present accelerated tests.

The chief objection to roof tests was that the conditions of exposure were not controllable. What was needed was a " not-so-accelerated-test " for use as a research tool rather than an acceptance test. The test should be designed to last about two months and be accelerated by three factors : (1) either keeping the surface continually moist, or perhaps alternating condensing and drying conditions ; (2) using a higher temperature than ambient ; (3) using slightly higher concentrations of corrodents than were met in service.

To illustrate the last point he would mention that 1 per cent of sulphur dioxide was used in the test as now laid down, compared with 0.00001 per cent in the air of large cities. Barton had recently suggested that 0.01 per cent would be better, as it reproduced the type of attack found in service. Such a test would be of great assistance to future work.

DR. S. WERNICK (Hon. Secretary) said that what emerged clearly from the paper was that there was preferential corrosion of the copper under the nickel coating, suggesting that the copper was a deleterious undercoating. He wondered whether, in fact, the authors would now really go so far as to say that on this evidence they would recommend that copper should, in fact, not be deposited under the nickel. This would cut across a considerable amount of current opinion. Many plants up and down the country — some very extensive — were based on copper undercoating.

Some people thought that if the copper were

polished prior to being plated it helped the corrosion resistance of the ensemble. He did not know whether the authors had tried to ascertain the effect of different types of copper finishing prior to thet application of the nickel deposit. What he had found most interesting in the copper section had been the relationship between the cyanide copper and the sulphate copper layers. In depositing on steel the cyanide bath came first, before the acid bath but unfortunately it was the cyanide copper that appeared to be anodic to the sulphate. Had the reverse obtained it would have been a happy situation. Would it be helpful if one deposited first a flash of nickel, after which one could proceed with an acid bath rather than in the reverse direction ?

The SO_2 test seemed inferior in its simulation to the accelerated-salt-spray and Corodkote tests, and in view of its growing use it might be necessary to review its efficacy and further spread up and down the country. In the introduction the authors had said that porosity in the nickel layer was now generally discounted as a major cause of break-down of nickel + chromium coatings but he would submit that this was a rather categoric statement. It might encourage a drift once again towards a reduction of nickel thickness, which would be deplorable.

MR. H. SILMAN (Electro-Chemical Engineering Co. Ltd.), while agreeing with the authors that the corrosion products of copper accelerated the corrosion of nickel and chromium, thought they were going considerably too far if they deduced from this that the substitution of copper for nickel in deposits was under all conditions likely to be deleterious. Many other factors were involved. These influenced the durability of combined deposits, particularly structural aspects.

Value of Heavy Buffed Copper Deposit

Referring to nickel-chromium plating, he said that there was a good deal of experience of the value of heavy buffed copper deposit under a bright nickel layer. With a properly selected copper-nickel ratio excellent results could be obtained, but he would not like to say at this stage that there was any evidence which would enable one to make comparisons between the durability of a heavy buffed copper nickel deposit combined with bright nickel and the double nickel layer. It would all doubtless come out " in the wash." All one could say was that the results were very good.

The photomicrographs indicated also that the form of attack at the boundary between the copper and the nickel layer was not so very different from that which took place between two nickel deposits.

Some years ago he had taken part in a test in which copper was applied between two dull nickel deposits in the form of a sandwich. There was no doubt that such a combined deposit was extremely durable, in fact, more so than a single dull nickel deposit of the same total thickness.

DR. S. WATSON (Int. Nickel Co. (Mond) Ltd.), then showed a number of slides illustrating the effect of corrosion on coatings that had been put on in the reverse order. As pitting increased, he said, one got preferential attack on the bright layer, which was now on the bottom ; and the semi-bright layer was less attacked. Showing specimens exposed on the laboratory roof for six months, subjected to the acetic acid/salt spray test, or to the Corrodkote test, he added that from a sample exposed to service conditions — $6\frac{1}{2}$ months on the front of a van in Birmingham — it could be seen that the inverted mushroom pit occurred under such conditions.

MR. U. F. MARX (Wilmot Breeden Laboratories) said that practically all the microsections of semi-bright nickel deposits showed a columnar structure. An exception was Fig. 12, where the structure was broken up a little. Had the authors carried out any measurements of anode polarization which tended to differentiate between a columnar and a broken-up structure ; in fact, had they attempted to relate the polarization to the age of the solution from which the sample was obtained. There was a certain amount of evidence that as a solution aged the nature of the deposit changed and it would be interesting to know whether the polarization did likewise.

DR. J. EDWARDS (B.N.F.M.R.A.), referring to the systematic exposure tests on laboratory-prepared specimens, asked whether the authors had noted the proportion of pits in the various coatings which penetrated to the basis metal, and tried to record the overall appearance of the different types of coating.

The work done on plated die castings at B.N.F. had so far not demonstrated any appreciable advantage in corrosion resistance of duplex nickel over bright nickel. Often it was not possible to distinguish, by a visual examination, between the two with the same chromium thickness on the top. Evidence of superficial corrosion was not altogether absent. One could in some cases see it in a microsection. Within six months of exposure at Euston the majority of pits had penetrated to the basis metal, resulting in blistering. A number of plated steel samples which he had shown as illustrating the benefits of nickel had had 20 or 30 pits to the square inch, the pits being 0.020 in. or more across, whereas on other samples, where penetration to the basis metal was much delayed, there were hundreds or even thousands to the square inch and only a few thousandths of an inch across. Did the authors feel that the benefits of duplex nickel were most likely to be exhibited when the density of pitting was high ? He

(Back row): Mr. G. A. Moodie (R. Cruikshank Ltd.), Mr. G. H. Turner (R. Cruikshank Ltd.), Mr. A. J. L. Nash (R. Cruikshank Ltd.), Mr. G. V. Dance (R. Cruikshank Ltd.), and Mr. L. W. H. Eyers (R. Cruikshank Ltd.); (Front row): Mrs. G. H. Turner, Mrs. L. W. H. Eyers and Mrs. A. J. L. Nash.

realized that this was not in accordance with much of the work that had been done on the subject.

MR. A. H. DU ROSE (Harshaw Chemical Co.), said that, in his experience, given low thicknesses, if one were to expose on a static exposure site duplex nickel versus bright nickel, on either steel or die castings, there would not be much to choose between them. Further to what Dr. Edwards had said, there would be a slight preference for duplex, but it would be very slight. However, when one went to actual service conditions it was quite different. Duplex nickel then had a definite advantage.

" Service Conditions "

Just what was meant by " service conditions " ? These could, of course, vary with location, particularly in the United States. It was possible to obtain differing results on the sea coast at a non-industrial site and, say, New York. Also, much depended on how frequently the panels were washed. One spoke of accelerated tests, roof static exposure tests and service tests, but there were various modifications of all of these. One had to strive for reproduction of average service conditions, but what " average " meant in this connexion he did not know.

DR. T. P. HOAR (University of Cambridge) asked whether the authors had any idea why copper appeared to be more basic under these conditions than semi-bright nickel.

DR. D. N. LAYTON (Ionic Plating Co. Ltd.), taking up Mr. Rose's point concerning washing, said that one was commonly told that Rolls Royce and Bentley cars did not rust. One reason was that the chauffeur washed it regularly, and the other was that the plating was of better quality. The chromium plating on mail delivery vans in Birmingham was quite good. They were washed each night by the drivers before being put away. He considered it extremely significant.

MR. L. W. HARRIS (Morris Motors Ltd.), said that one of the commonest forms of breakdown on zinc-base die castings was blistering. The only microgroove in the paper which related to a zinc base showed a rather broader type which did not look as if it would develop into a blister. It would be desirable to extend the paper to include the examination of break-down on zinc-base die castings.

Author's Reply

MR. G. N. FLINT, replying, said that the work on accelerated corrosion tests was still proceeding and the comments made would be very useful in planning future research. In regard to the copper undercoat, he would emphasize that the tests carried out were primarily designed to ascertain the type of pitting which occurred. They had not, therefore, paid much attention to the actual performance rating of coatings on the samples exposed. The pits shown had been very carefully selected as typical. It was easy to produce a set of photomicrographs to support any story that one wished to tell. In order to give some idea of the variability of the type of pit that could be obtained they had taken the number of each type, and these would refute any suggestion that the photomicrographs were biased, should it be made.

He did not know of a good explanation why copper was more basic than semi-bright nickel, but in the so-called galvanic series copper was regarded as more basic. This and been deduced

(Continued in page 233)

A Quarterly Survey of some of the Features in Finishing Literature from Abroad

by **SCRUTATOR**

REPORTS in the technical press over the past few months have indicated that the manufacture of prepainted aluminium strip is "big business" in the United States. This view is further supported by the most recently released news of still further increased production capacities at the Kaiser Aluminium and Chemical Company, Ravenswood Works[1]. To meet the increasing demand for pre-coated aluminium in the construction and mobile home industries, Kaiser, Ravenswood, began producing painted strip last year on an 18-in. and a 66-in. line. They estimate that 90 per cent. of the mobile homes built in 1961 will have aluminium sheathing, of which more than 75 per cent. will be pre-painted and this, coupled with the demand for pre-painted aluminium strip for shutters, roofing, gutters, fascia, awnings, carports, screenframes and weatherstrip has resulted in Kaiser laying down an addition new 48-in. reverse roller coating line which it is hoped will be in operation by the Summer. Capable of coating both sides of a coil of aluminium with different colours at speeds up to 100 ft. per minute, this new line will mean that the end-products from the three Kaiser lines will cover strip widths of $\frac{3}{4}$-in. up to 66-in. in gauges of 0.006-in. to 0.064-in, finally coated with alkyd amine, thermo-setting acrylic or vinyl finishes.

The surface preparation on all the plants is similar and comprises the following 5 spray stages :

1. Non-etching alkali type cleaner — 150-175°F. — 20 seconds.
2. Water rinse — 130-140°F. — 5 seconds.
3. Chromate conversion — 90-110°F. — 10-15 seconds.

   Ion-exchange equipment is included at this processing stage to ensure that the composition of the solution remains constant and therefore perfectly reproducible coatings, from the point of view of chemical and physical characteristics, are produced irrespective of the age of the bath.
4. Cold rinse — 5 seconds.
5. Acidulated rinse — 130-140°F. — 5 seconds.

It will be interesting to see how long it is before a wide or medium-width pre-painted aluminium strip line is laid down in this country.

Another expanding market for aluminium is the automobile field. Recent experience by General Motors[2] has, however, lead them to conclude that at the present stage of the art the plating of aluminium for exterior surfaces has not yet been sufficiently developed to a high enough degree of reliability. While the zincate-zinc system is more promising as compared with phosphoric acid anodizing, they believe that before any large-scale adoption of chromium-plated aluminium can be recommended, further actual outdoor exposure testing is necessary. It will, therefore, be some time before any plating system for aluminium for outdoor exposure can be considered by them as established.

Still on the subject of aluminium and cars, Kaiser predict[3] that car wheels will be the next automobile part to be made from aluminium. Increased cost as compared with a steel wheel is, of course, one of the main disadvantages but they believe that this will be overcome very shortly. At the present moment, Pontiac offer aluminium wheels as an optional extra at 100 dollars per set.

Plating

Electroplated cobalt-nickel deposits are widely used as magnetic recording media. The advantages of these over oxide coatings are claimed to be greater simplicity of preparation and the comparative ease of obtaining a very wide range of magnetic properties and film thicknesses. Details have been given[4] of a new cobalt-nickel sulphamate bath in which boric acid is not required for *p*H control but does have some influence on the coercive force of the deposit and in which the presence of chloride is important as it increases the limiting current density at the cathode. A high concentration of sulphamate ion in the bath is undesirable as it influences the activity of the chloride ion.

Another out of the ordinary application for electrodeposits is for stopping-off during the Boriding of steel[5]. Boriding is somewhat similar to case hardening in that the object of the process is to produce a hard, abrasion-resistant diffusion layer. The protection of local areas which do not require treatment is difficult as Boriding is normally carried out by electrolysis in molten borax. The part to be treated is made the cathode and has to

(*Continued in page* 234)

The Planning and Construction of INDUSTRIAL PAINT SHOPS

B. VAN DER BRUGGEN

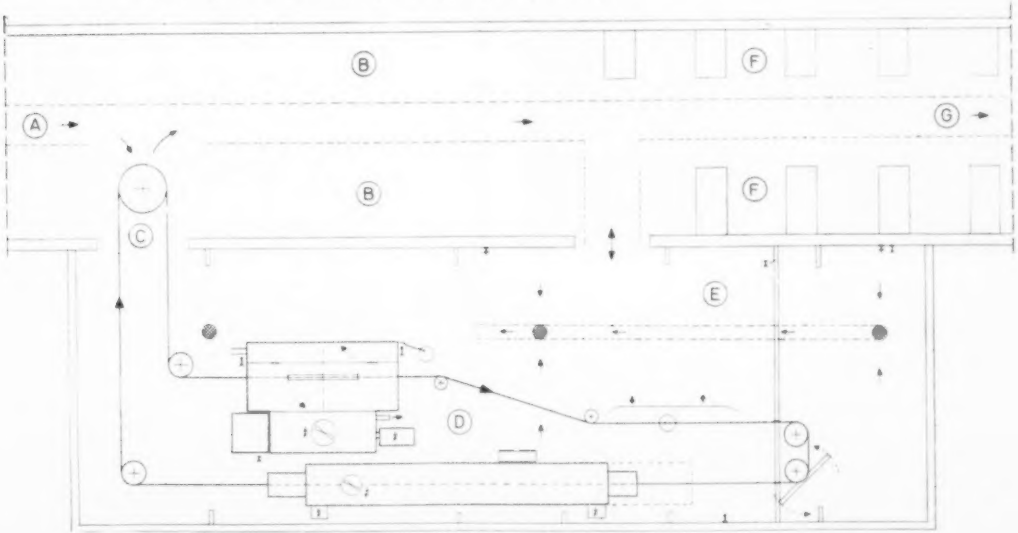
1. BUILDINGS AND EQUIPMENT

THE increasing mechanization and in some cases also the automation of industrial paint shops are based on the utilization of modern production line equipment of the continuous channel or tunnel type, linked mainly by mechanical conveyors. Installations of equipment and conveyors of this type can be subdivided or combined as required. This form of arrangement which approaches the optimum only by correct structural designing, sets requirements in regard to the buildings, paint shops and construction, fundamentally different from those arising in the case of the separate unit equipment previously used, principally for non-continuous working (*e.g.* dipping tanks, spraying tables, drying stoves, etc.). In most cases these were erected anyhow and anywhere, in ordinary shop spaces, without the need for direct communication being taken into account. The attainment of production flow, the efficient realization of which is the aim of every new installation, requires a judicious co-ordination of the mutually influencing structural and plant-conditioned factors and requirements.

These requirements, particularly those relating to the external form of the structure, become very difficult to satisfy in practice, due to the fact that, as yet, the industrial paint shop has only in rare cases been allotted a separate new building of its own, for which only a few structural features have been developed.

As a rule, the paint shop has to be set up as one of a number of manufacturing stages in an existing building or in small spaces, the characteristic features of which have been developed in relation to preceding manufacturing stages. Because of this its structural layout is in most cases predetermined, even if it is a case of a separate, new building, in the form of an annexe. Where it is not, or is only partially the case, then the nature of the manufacture and the size of the existing paint shops determine the form and size of the shop to

Fig. 1.—Layout of a paint shop for packaging containers: (A) Fabricating shops (fitters' shops, etc.); (B) Painting shop with conveyor and tunnel stove; (C) Space-ventilating unit; (D) Conveyor to assembly and shipping line; (E) Conveyor to store or stock pile (Layout plan by author).



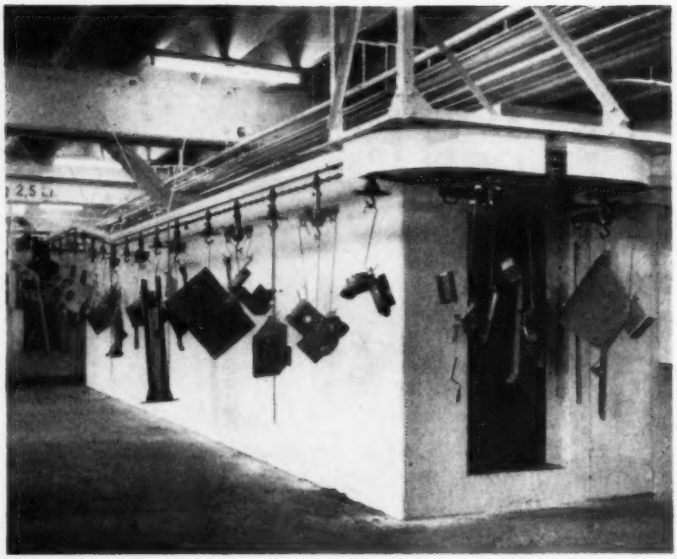
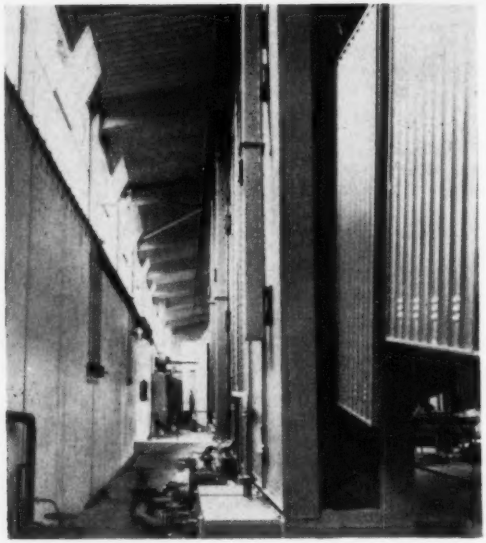


Fig. 2.—(right) Conveyor track in a mechanized paint shop with chain guards on guide sprockets (foreground).

Fig. 3.—(below) Entry opening of an overfloor, flow-coating tunnel.



be erected, moved, or rebuilt. In view of the constantly changing requirements from shop to shop, not only in each branch of manufacture (nature and size of the work pieces) but also according to the output (number of work-pieces per day) and the different processing treatments (type of plant), it is inevitable that installations already erected elsewhere have in practice no comparable feature in regard to size and shape of the available space, for which reason it is not proposed to reproduce ground plans here.

The extent of the differences varies from case to case, but does not alter the fact that the paint shop, with its equipment, introduces a whole series of special, and often recurring requirements in regard to the structural embodiment of its working spaces which are little influenced by the size of the building and its external form. These requirements must be taken into account where, overstepping the limits of an isolated unit, an installation is desired which offers scope for modification and for expansion and thus, at a reasonable cost, a plant of permanent value is to be created.

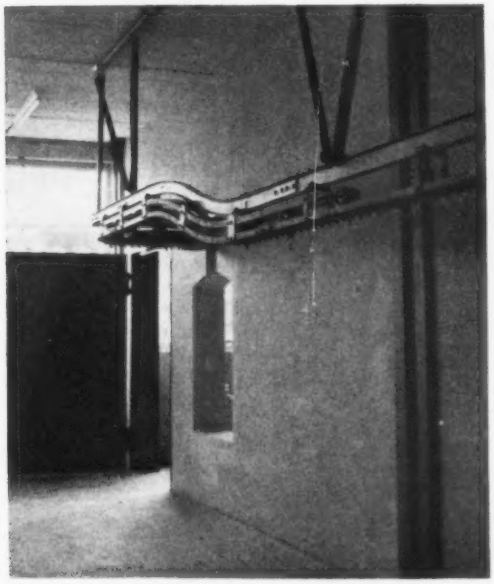
Since, unlike many other manufacturing processes, the equipment for which is only linked to its accommodation by bedplates or foundations, and power points, the paint shop, with continuous-flow equipment and conveyors, is characterized by a multiplicity of connections between the equipment and the accommodation space, affecting the building and its construction. In addition to the electrical conductors, these include pipe lines for water, solutions and paints, power lines for hot water or process steam, discharge points or floor drains for water and corrosive solutions, compressed-air pipes, ventilating ducts and extracting or suction points in the equipment or in the shop, feeds to air and tank heaters, suspension means for conveyors and lighting equipment, wall openings for ducts and work conveyors, spaces or partitions for heating boilers, settling tanks, air-conditioning, as well as other heat and fire screening means required according to the regulations for the safety and health of the workers.

The resulting interlock between structures, spaces, auxiliary shops and equipment, forces

structural planning to develop in other directions, exceeding the scope of the planning of a new building. It makes it necessary, even in cases where equipment of a specified kind is to be installed in an existing building, to create the necessary structural prerequisites for this. Otherwise, an adaptation of the equipment to fit an existing location is hardly the best means of achieving the optimum benefit. Sooner or later it will require to be expanded by structural additions or by a second installation in another place.

Such a development is, however, avoidable if there is efficient planning, and the degree of expansion or adaptation required, to meet increased production and changes in the manufacturing programme can in most plants be foreseen. Also it must be clearly appreciated that in regard to increased production, this is not to be achieved, as in many kinds of mechanized manufacture, by installing an additional machine tool, where it is a question of correlation with the purpose and possibilities of the successive processes " in flow production." A soundly designed installation should thus be erected, both in regard to equipment and layout, in such a way that, while flexible and capable of expansion if necessary, it remains within the scope of foreseeable and financially possible limits. Only then is it possible to speak of an installation of permanent value. From the first planning stage onwards, a versatile and flexible arrangement of the equipment and a lay-out offering scope for expansion do not permit too close a linkage between work shops and production plant. This calls for the exact fixing of plant efficiencies and the possibilities of increasing them. By avoiding excessive subdivision of the available space (partition walls), buried equipment (floor pits), masonry ducts, etc., all of which impede the mobility of the equipment and its subsequent expansion, a considerable reduction in building costs can also be achieved.

Fig. 4.—Separate communication channels for personnel and work-pieces.



The overall planning sequence, upon which depends the detail of the structural planning, is essentially as follows :

(a) Determining the most suitable treatment process and the resulting work cycle (laying out the flow path and conveyor equipment) :
(b) Planning the layout of the necessary floor area, governed by (a), the shape of the building or space, or adapting it to an existing building ;
(c) Fitting in the auxiliary plant requiring structural work and the connections to the services such as heating, ventilation and filtering plant, drains, ventilating passages, etc. according to (a) and (b).

If the problem is not dealt with in this, or a similar sequence, subsequent structural modifications (breaking through walls, raising floor levels, etc.) can lead to considerable additional costs and, what may be even more important, force an adaptation of the plant and processing to the structural features. Problems of safety in working may also have a decisive influence on the buildings or form of layout, the position, the division into separate areas, which may be necessary. Safety requirements must therefore be taken into account where it is desired to avoid subsequent modifications of the buildings. Rational selection of colour for the working spaces and the equipment also plays a part in the satisfactory design of a shop. Particularly in the case of flow production work, it makes a useful contribution to the measures promoting work, facilitating supervision and reducing risks.

The problems of working safety and selection of colour are dealt with in greater detail in a later section. In the next section, however, a series of frequently recurring questions on the structural planning will be discussed.

Problems of Buildings and Layout

Position of the building. Where not already determined by the processing cycle, the position of the paint shop is determined both by the available communications (transport facilities), the possibilities of temporary stock-piling, distance from the assembly point, etc. Where a choice between two or more sites is possible, additional factors, relating to the whole plant will determine the decision.

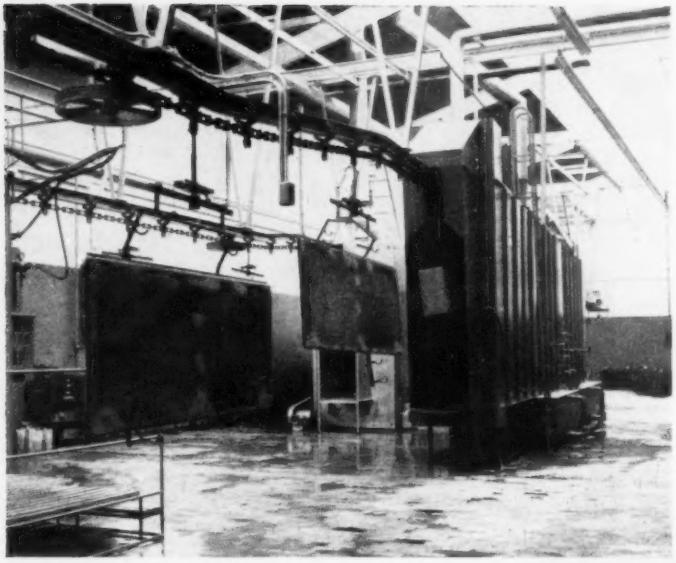


Fig. 5.—(left) Part view of a large paint shop with tunnel units for pressure blast cleansing and enamel stoving on easily cleaned flooring.

Fig. 6.—(below) Paint drying chamber in a wood furniture factory. Walls of brickwork heat-insulated.

Kind and shape of building. An annexe or a new building, as a rule, mainly for architectural reasons, will require to be adapted to the existing factory buildings. Basically, the choice is between the following building forms : a) work-shops with top lights, Figs. 3, 5 and 11 : b) shop spaces, with horizontal, continuous ceilings or with a roof of the kind usual in multi-storey brick or concrete buildings, Figs. 2, 6 and 7. Both kinds of construction have advantages and dis-advantages. The type of manufacture (type of work to be processed), together with other particular features, is the determining factor. The layout will, where possible, be adapted to the installation layout and should provide scope for extensions. For installations with longer conveyor tracks and tall equipment units, Figs. 3 and 11, an elongated layout in a building of the open shop type is suitable. Arrangement of the installation on a floor area without partition walls Fig. 5, is in most cases preferable to subdivision into sections or cubicles, Figs. 7 and 9. Special fire risks may dictate the opposite.

Roof. In shops of the kind which allow a vertical lead of the ventilation ducts, a roof pitch of 10 to 20 is correct (accessibility, convenient duct cleaning, sunlight damping treatment for windows). It is advisable to incorporate a heat insulating layer (heat transmission from the equipment plus radiated sunlight). Tarred roofing materials and plastic sheeting are not suitable (inflammability, deposits, duct outlets). Where only sloping toplights are provided, they must be suitably sloped to prevent snow adhesion.

Floors and Walls : Floor surfaces should be resistant to chemicals and to abrasion with a slope of 1 to 2 per cent towards the drain outlets. Plastic coatings not infrequently favour the adhesion of paint dust which makes cleaning difficult. Galvanized gratings placed over floor pits have proved reliable, Fig. 13. Figs. 5 and 12 show an easily washed floor coating applied in liquid form. Cubicle walls should be smooth, to prevent dust clinging, and should be washable (painted).

Doors and Windows. Doors should be made of metal or hardwood, if necessary with a sound-

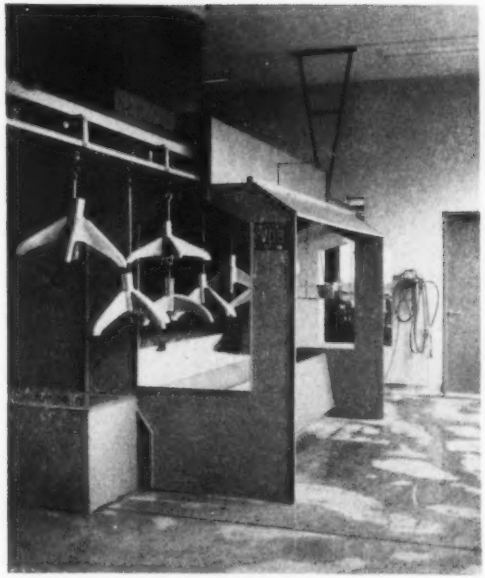


Fig. 7.—Paint shop with reinforced concrete ceiling and brick walls; on the left, conveyor openings for work-pieces.

proof lining of mineral wool, and should open outwards. Where most of the transport is done by conveyors, single-leaf doors are sufficient Figs. 4 and 7. Where trucks (electric trolleys, etc.), are used, double doors swinging in both directions are advisable. There must be adequate spring to keep the doors closed in the event of fluctuations in the atmospheric pressure (over-pressures). In special cases (dust protection) double doors may be necessary. Windows should not have any plastic panes (incombustible) fitted, at least, not in the vicinity of the drain outlets (discharge of dye particles, adhesion). Where only top lights are provided (shed roofs), the window area should be correctly dimensioned, (room height, snow loads, sunlight proofing), Fig. 18. Windows in side walls, Figs. 14, 15, 20, whether alone or as supplementary lighting, frequently provide a brighter lighting effect, but they are frequently obstructed by processing equipment and conveyor tracks. Sunlight dimming measures may be indispensable.

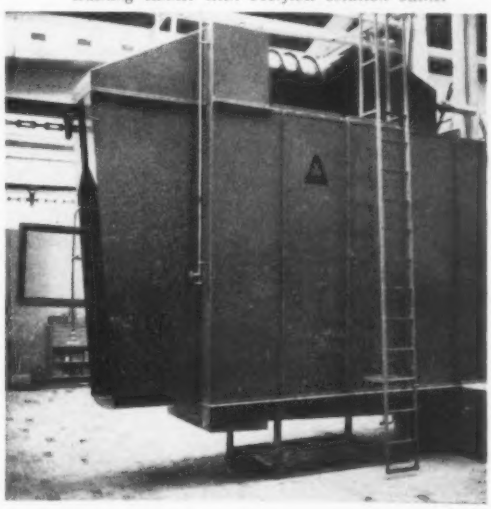
Room for expansion. There are two possible ways of ensuring the very necessary reserve space in the case of new buildings: on the one hand, by building on an annexe in the direction of the conveyor track at a later date and on the other hand, by extending the length of the installation (zoned expansion) which requires from the outset a larger surface area (building costs). The choice between the two alternatives is decided by assessing the prospects in regard to production expansion.

Auxiliary and accessory spaces (cellars, upper storeys). In large installations and where the floor area available for the equipment is limited, cellar space may be useful (paint store, paint issuing room, filtering installation, heating boiler, compressor space). A processing unit of considerable length (for instance, a tunnel stove) can also be installed in an upper storey where the conveyor tracks (gradients) permit this. This vertical connection of the equipment in different storeys will impair mobility and thus an eventual extension of the installation.

Processing Equipment and Work Conveyors

Form and nature of equipment. The need for eliminating manual transport and handling requires production-line, continuous flow installations. The following pictures show arrangements for mechanized throughput of work-pieces, which are not closely linked to the actual building. Fig. 5 shows a metal-washing tunnel with overflow tanks. Fig. 11 shows a flow-coating installation which, in spite of its great height, also has not been dropped below floor level; and Fig. 10 a paint-spraying point which raises the sprayer position and thus is also movable. By reason of this mobility, changes in the installation and expansion are facilitated and are possible without great expense. Exceptions (floor pits) are in some few cases unavoidable, but as a rule preference should be given to methods and structural forms which permit horizontal conveyor paths. Exceptions may be encountered in the case of large drying spaces, Figs. 2 and 6,

Fig. 8.—Drying space of a pressure blast, sheet-metal washing tunnel with overflow solution baths.



since frequently it would be too costly to instal them as sheet-metal structures. If suitably constructed, however, (cavity brick, masonry, insulated), these spaces can easily be broken through if need arises. Basically the arrangement should be movable to allow for any lengthening of the production chain. A considerable part of the equipment installed today, however, is so linked to the building structure or is so constructed that a level throughflow of components can only be attained by sinking a large part of the fitments in floor pits, on account of which shifting the equipment or extending the production line can in many cases not even be considered. In the case of an arrangement which is to be of permanent value, it is therefore necessary to pay attention from the outset to mobility and, with heavy, large-scale equipment, (with bulky articles to be treated), to envisage a subsequent additional zone or an intermediate structure. The costs of floor pits is also in most cases considerable and in paint shops in the upper storeys they are exceptionally difficult to contrive or cannot be provided. Undesirable production bottle necks arise with increasing frequency, where the number of work-pieces begins to exceed the shop capacity, but is not sufficiently large, however, to justify a second installation or shop. In such cases, a limited expansion of the existing shop, assuming a correspondingly suitable plant layout, can frequently be justified by the correspondingly higher work throughput.

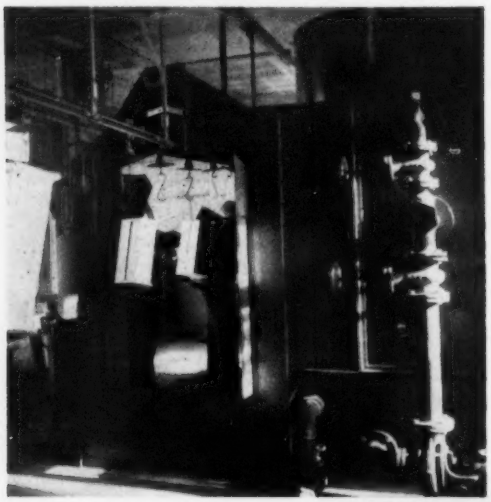


Fig. 9.—(above) Movable paint spraying cubicle in a steel furniture factory, showing the piping for air blast washing.

Goods conveyors. Overhead, suspended conveyors are always to be preferred to the less frequent belt or roller conveyors on a substructure. As these devices are usually carried on columns etc., freedom of movement along the conveyor paths and equipment is often impeded and the radius for the movement of the work-piece underneath the chain sprockets is not infrequently limited by the spacing of the supporting columns. Figs. 5 and 14 show a suspension arrangement for I-beam roof girders, in open-shed structures, Figs. 4, 13 and 17 a suspension arrangement with Jordal tie rails on concrete or masonry ceilings. Both securing methods permit relatively simple and rapid variation in the conveyor path, if the I-beams or the tierails are suitably positioned. The other conditions and requirements in each case (as, for instance, pieces to be conveyed, weight involved,

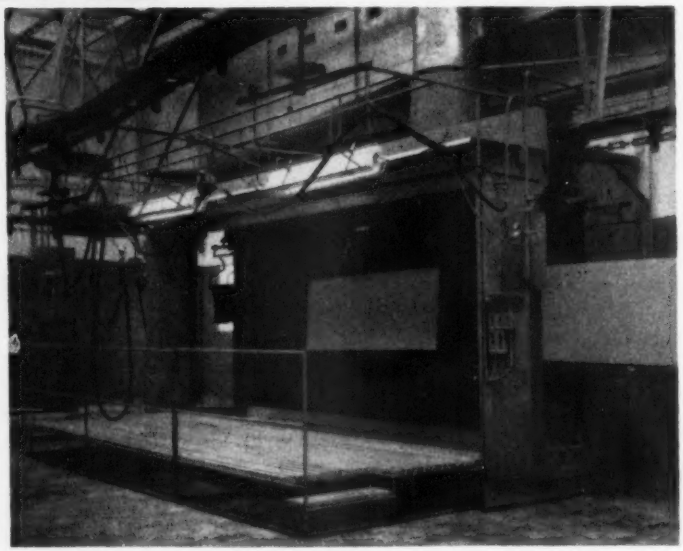


Fig. 10.—(right) Continuous paint application unit for a switch panel fabricating line with chain conveyors for rotatable work-piece conveying and electronic feed control ; a part of a painting installation in six, separate sections, without partitions ; the colour scheme of the accommodation and equipment aims at intensified contrast between the stationary and moving work-pieces.

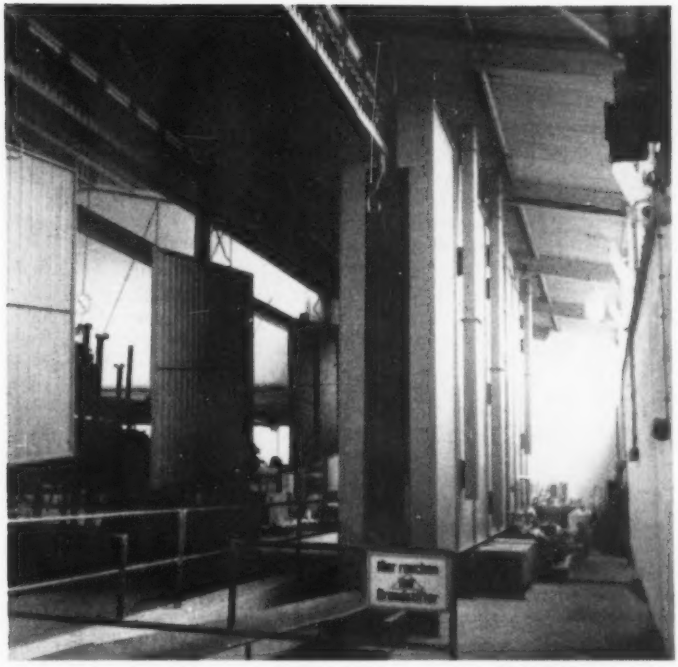
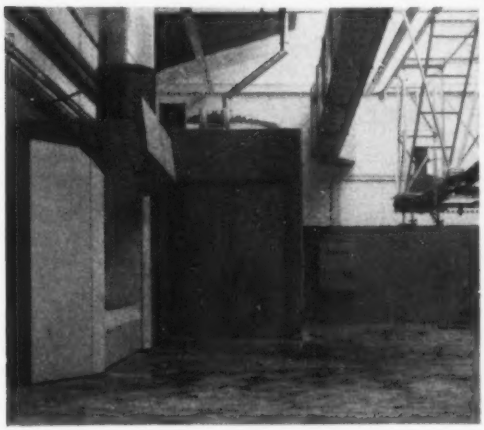


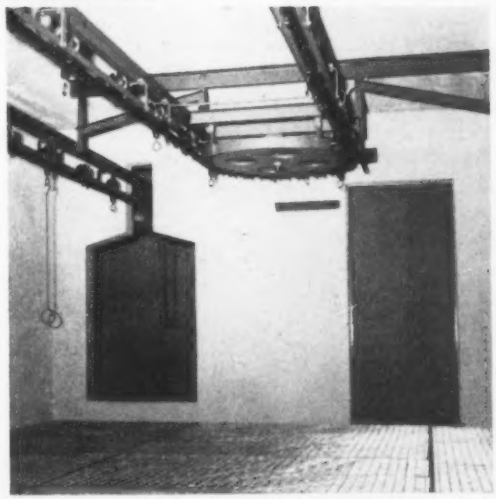
Fig. 11.—(left) Flow coater (VDB System) for the automatic painting of Berry Shed Doors; equipment and conveyors are installed in the side-bay of a long and lofty main shop; the colour scheme of the tunnel is deliberately made in the same colour as the paint used in the installation.

Fig. 12.—(bottom left) Equipment for painting large components in situ, with floor turntable and hoist lift to drying chamber (in background).

Fig. 13.—(bottom right) Internal view of a drying chamber with grille-protected, radiant floor heating.

distances, temperatures, dust) require the choice of a conveyor (chain, tubular, cable type, etc.) according to the particular characteristics. A common feature of this type of conveyor is the loss of efficiency in cases where steep rises and falls in the conveyor path necessitate a wider spacing between the pieces being handled (for instance, to and from chain servicing points, dipping tanks, connection between storeys, etc.). Pronounced differences in the conveying height can often be avoided by using exposed equipment. Rising and falling curves can in addition necessitate a much





longer conveyor path (length of equipment, space requirements, building and equipment costs).

Ventilating equipment. The air-conditioning units for these installations (air supply, dust-extraction, heating) in large paint shops or in cases where several cubicles or installations require to be ventilated, can be combined in a separate room or can be hung individually in the form of separate units, at each ventilating point (distribution duct) in

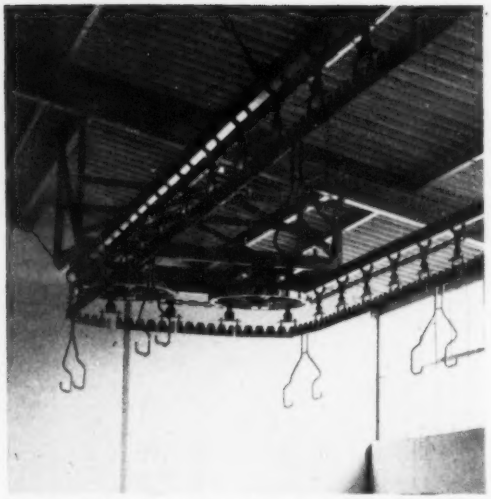
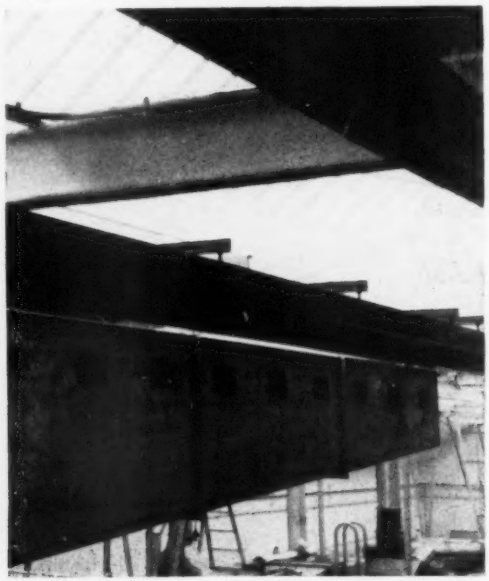


Fig. 14.—Reversing point and suspension of an overhead conveyor.

the upper part of the room. The latter arrangement is not infrequently more suitable since the units and distributing duct can be moved or augmented more easily than a large, often built-in air distributing unit. The volume of air to be delivered per duct and enclosed space can also be regulated more reliably where limited tasks are in each case allotted to several, more restricted air conditioning stations. Both types of arrangement feed and distribute the air more effectively through sheet-metal ducts (smooth inner surfaces, easily washed out, easily movable). Figs. 16 and 17 show two different forms of suspended distribution ducts of this kind. This form is of permanent value and permits unimpeded suspension from conveyor equipment. Perforated intermediate ceilings serving for air distribution are unsuitable for paint shops, often blocking the light from above and always making it difficult to lead air discharge pipes through the roof (opening work). In static conditions, rising warm air frequently deposits dust on the inner side of the intermediate ceiling which in most cases cannot be washed out, but can only be reached by dismantling. Distribution ducts can also more efficiently ventilate individual spaces or room sections, as is necessary, particularly for paint spraying areas and conveyor sections loaded with freshly painted work-pieces, which must be kept dust free. In the case of built-in air ducts, fixed intermediate ceilings, and the like, any reconstruction of the arrangement usually leaves only a few air-conditioning ducts or units available for further use. The arrangement of air ducts, their laying, etc., is more difficult in full-wall buildings and shops (*e.g.* concrete structures) compared with shed structures (wall-piercing work). On the other hand, the ventilation and maintenance of a positive pressure is not always simple in more lofty, shed-type buildings (rising air, roof permeability).

Fig. 15.—Illumination of a working point by natural daylight; large-area wall glazing.

Fig. 16.—Freely-suspended, washable space ventilating duct.



Auxiliary Services, Power Supply and Pipe Lines

Boiler house. In cases where the existing hot water or steam plant is used to capacity, where it is shut down during the hot summer months, etc. if the paint shop has a high heating requirement, the installation of a separate hot water boiler may be economical. A special space will be required for this, particularly if other auxiliary units (compressor, settling tank, ventilation plant, etc.) are also to be fitted. Although the cost of electric current varies according to locality, it is almost always too expensive, which should give an opportunity for the use of suitable cheaper fuels, if oil burners fitted directly to the equipment are not desirable (*e.g.* in metal washing equipment) and where other heating points, such as air heaters, etc. are to be connected. Where gas heating is not desired, then electric heating is restricted only to the high temperature equipment (stoving kilns).

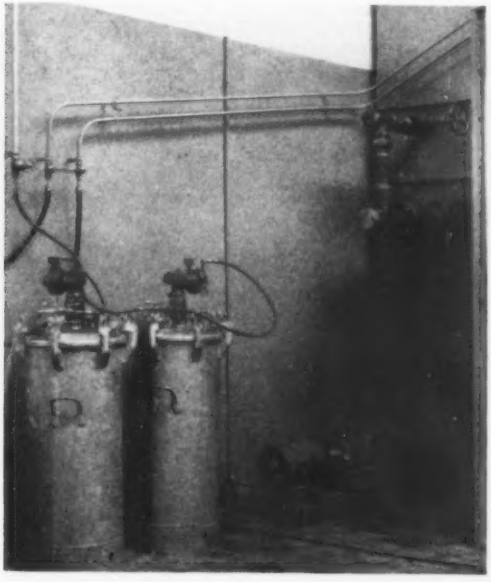
Filtering (Settling) equipment. An installation of this kind is necessary where large amounts of substances in solution are discharged from the equipment (spraying points, degreasing tanks, derusting equipment). Their neutralization can be undertaken in a smaller installation, however, if necessary also in a makeshift soaking pit, when the solutions to be disposed of are partly acid and partly alkaline, by which means they can neutralize each other, if they are allowed to flow together.

Fig. 18.—Skylight glazing for a lofty paint shop.

It is a structural problem to make provision for the correct positioning of floor drains and the pipe lines to be provided under the floor surface, also suitable gradients and cleansing facilities, bearing in mind the anticipated quantities and types of solutions involved. Where gradients, diameter or accessibility of the pipe system leading to the

Fig. 17.—Shop ceiling with suspension rails for portable conveyor fittings.

Fig. 19.—Paint-distributing containers, with agitators and pipelines.



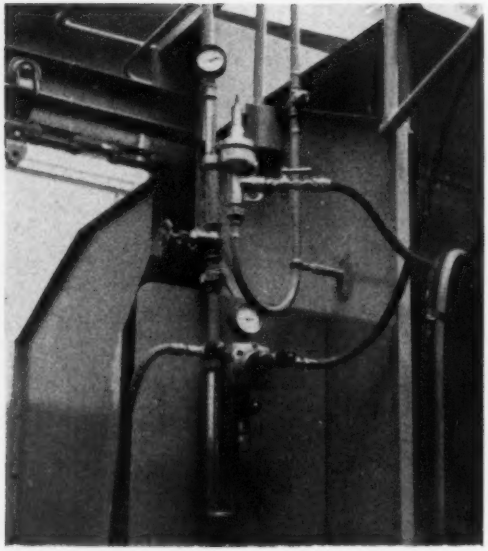


Fig. 20.—Paint and air pressure reducing valves at the working point.

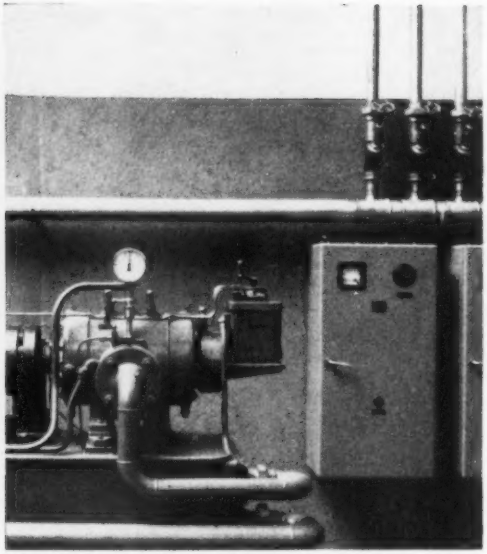
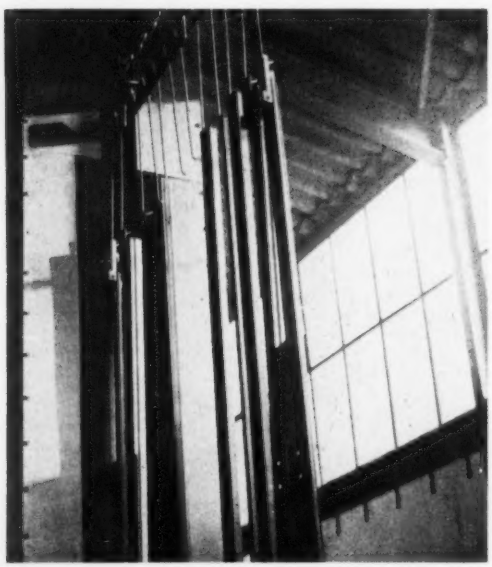


Fig. 22.—Partial view of the compressor plant with the branching air pipes.

filtering plant does not meet all requirements for instance, in the case of viscous paint residues from the spraying points, costly operations to remove floor coverings may be involved.

Paint Store. The store is separate from the paint issuing room or the paint-store with distributing containers and should preferably be set up even outside the factory building. The paint issuing room, on the other hand, should be located in or alongside the paint shop and thus the pipe lines for the paint can be made shorter. Where it is only a question of a few tight-sealing distributing containers, a separate distribution room can be dispensed with. Figs. 19 and 20 show a distributpoint of this type with pipes and a paint drawing ing point with paint pressure control, at a spraying point.

Fig. 21.—Glazed shop side-wall along the whole conveyor track.



Water, compressed air and electric supply lines. The water supply is preferably in the form of a ring main since for the equipment (tanks, rubbing down points, etc.) and in particular also for washing out the bays (hose connections), a number of connection points is desirable. For the compressed-air supply, on the other hand, subdivision of the main pipe line in the early stages may be practical. By this means, it is possible to avoid leaving several installations without air during repairs or pipe cleansing operations. Fig. 22 shows part of a rotary compressor with a main pipe and branch lines. The installation comprises two, separately controlled compressors as, generally speaking, the provision of two smaller units is to be preferred to one large compressor. It is important for the moisture content of the compressed air that the compressors draw in dry, cooler air and that the feed pipes are set at a slope (flow of condensation water in the direction of the air flow).

(To be continued)

Metal Finishing Conference

(*Continued from page* 221)

from the potentials measured in flowing sea water. In the latter, removal of copper corrosion products could occur, and in atmospheric corrosion there was removal of copper ions by precipitation, tending to make the copper more active. Also, he thought that nickel was more ennobled by exposure to oxygen than was copper. There were thus two reasons — one on the cathode side and one on the anode side.

So far as future work on accelerated corrosion tests was concerned, they were treating it as an electro-chemical problem. It was a matter of trying to accelerate the corrosion rate by a factor of something like 500 to 1000 times. One could reduce the electrolyte resistance or make the anode more active. The essential thing was to try to keep the factors in balance. The work that the Russians were doing on atmospheric corrosion was very important, and it was possible to apply it to the accelerated corrosion tests. They had shown that it was cathode polarization that was the major controlling factor ; but it could not be the only one or there would be no difference in the behaviour of undercoats.

Their experience with copper undercoat, and the " sandwiches " mentioned, was confined to the photomicrographs. It had been shown that there was a difference between cyanide copper and acid copper. There was also some effect of bright copper. There were differences in the polarizability of bright and cyanide and sulphate coppers ; so one could get a bright copper that would corrode fairly rapidly, but they had never noticed this in service. They had noticed the behaviour of bright copper deposits, but it had not had the same effect as double layer nickel deposits — it had not stopped penetration. They had had preferential attack of new copper but had not reduced the depth of penetration which was so characteristic of the double layer nickels in service. He would support Mr. Du Rose's comments regarding the service behaviour of the latter.

They had taken 40 or 50 specimens and examined them metallographically. Nine or ten of the double layer nickels were characterized by the fact that they were pitted but did not show rust spots. They had seen few pits that had gone through to the base metals — perhaps because the surface exposure time had been relatively short — never more than two years. Here again one had the problem of rating the specimen. If one rated it by surface appearance only there was not much difference between single layer nickel and double layer nickel. If one rated it according to rust spots and penetration of the base there was a tremendous difference between the two.

So far as porosity was concerned, they had examined more than 1000 pits and could recall seeing none in which this was the cause of breakdown : one could dismiss it as a major factor. The main cause was electrochemical corrosion, but porosity might well aggravate this.

(*To be continued*)

CELLON LTD. CELEBRATE GOLDEN JUBILEE

ON March 7, 1911, in a small shed at Clapham, London, Mr. A. J. A. Wallace Barr produced his first cellulose acetate solution for the taughtening of aircraft fabric and in so doing founded a business that has grown to the Cellon Ltd. of today. It was in 1913 that the first order for aircraft " dope " was received from the Government, and it was then that a small company, under the name of Cellon Ltd. was founded and arrangements for large-scale production was made. The company began to produce pigmented dopes in 1916, any after the end of the 1914-18 war put all its energy into the development of a range of industrial cellulose lacquers.

Continued expansion resulted in the opening, in 1926, of a branch in Birmingham and other provincial towns, and in 1926 the company moved to their present site at Kingston-upon-Thames. 1930 saw the introduction of a range of decorating paints based on synthetic alkyd resins and these were followed by air-drying industrial finishes, coach paints and stoving enamels, etc. Cellon Ltd. became a public company in 1936 and in 1945, after being wholly engaged during the war with finishes for the Services acquiired Merry and Minton Ltd., Birmingham, giving additional productive capacity for " cooked " varnishes and stoving enamels. In 1958 the company became a member of the Courtauld Group, and in 1960 a completely new paint application laboratory was opened. 1961 will see a great increase in the size of the plants at Kingston and Birmingham, and these expansions will include a new demonstration centre which is to be opened officially in September.

To mark their Golden Jubilee the company held a luncheon recently at Celanese House, Hanover Square, to which many friends in industry and the technical press were invited.

Overseas Review

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be completely immersed — partial immersion results in severe attack at the interface. Some form of stopping-off is therefore necessary. Recent Russian work on the use of electrodeposits for this purpose has shown that plated nickel is not satisfactory as it does not prevent diffusion and in fact allows the formation of the normal Borided layer under the coating. Under suitable conditions of thickness and quality, copper electrodeposits can prevent Boriding and copper plating can be used for this purpose.

The latest introduction to the field of electroless plating is electroless gold plating[6]. *Swan* and *Gostin* have given some details of a process which will produce 993.4 fine coatings from a bath containing.

Potassium gold cyanide	2 gm. per l.
Ammonium chloride	75 „ „ „
Sodium citrate	55 „ „ „
Sodium hyphophosphite	10 „ „ „

The advantages of the process over orthodox gold plating are 100 per cent. throwing power and uniformity of deposits which it is claimed make it particularly suitable for the electronics industry.

Cold Phosphating

Gibson[7] has given some details of typical savings made in America by the introduction of zinc phosphate processes using " cold " cleaners and " cold " phosphating solutions. A table shows the comparative temperatures and B.T.U.'s used per hour on a 6-stage conventional hot or cold phosphating sequence. Heat savings of up to 70 per cent. have been achieved and it is stated that by changing from a " hot " to a " cold " phosphating process the savings in heating are equivalent to 10-12 cents per automobile and 4-5 cents per refrigerator. Many statements have been made regarding the reduced heat requirements of these processes which are now finding increasing favour in this country, but this is probably the first time that actual data have been published.

In America vinyl plastisols are used for the tubs, lids and dish rails of dish-washing machines and these are given a surface pre-treatment consisting of a thin (150-200 mg. per sq. ft.) zinc phosphate coating followed by a final demineralized water rinse after the usual acidulated chromic/phosphoric acid rinse.

Cup Holders

Are you still troubled with your silver tarnishing ? If so *Dettner*[8] has published some details of two new patented processes for overcoming this. One is based on the cataphoretic deposition of aluminium or beryllium oxides and the other is an electrolytic chromate treatment.

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1. *Products Finishing*, 1961, **25**, (8), 38-46.
2. *Products Finishing*, 1961, **25**, (7), 34-37.
3. *Iron Age*, 1961, **187**, (18), 71.
4. *Plating*, 1961, **48**, (4), 379-381.
5. *Metal Finishing*, 1961, **59**, (4), 49-51, 53.
6. *Metal Finishing*, 1961, **59**, (4), 52-53.
7. *Metal Progress*, 1961, **79**, (4), 100-102.
8. *Plating*, 1961, **48**, (3), 285-287.

CO-OPERATIVE RESEARCH INITIATED BY METAL CONTAINERS LTD. and INLAND STEEL CONTAINER CO.

THE illustration below shows the new Passfield Research Laboratories recently opened by Metal Containers Ltd. and the Inland Steel Container Co., U.S.A., to carry out fundamental investigations into various problems associated with container manufacture on behalf of both companies. Metal Containers Ltd. are part of the international Van Leer organization and Inland Steel Container Co. are a division of the Inland Steel Co., U.S.A. Both companies manufacture containers in a variety of materials and the laboratories are a unique co-operative enterprise which will allow free interchange of technical knowledge between the two organizations who will also profit from each others' vast experience of container manufacture.

FINISHING
NEWS REVIEW

RECORD TURN-OUT FOR JOHN PRESTON TROPHY COMPETITION

Inauguration of new Golfing Society for the Finishing Industry

THE membership of the Institute of Metal Finishing like any other arbitrary cross-section of society, includes a number of enthusiastic golfers and therefore it was only to be expected that those of them who attended the Annual Conference of the Institute, which was usually held at a venue where facilities for golfing were good, should avail themselves of the opportunity of getting together for a game. It was in 1952, however, that some semblance of organization was brought into the golfing activities of delegates to the I.M.F. Conference, when Mr. John Preston put up the now well-known John Preston Trophy for competition as part of the social attraction of the Conferences. Competitions for the John Preston Trophy continued to be held in association with the I.M.F. Conference for a number of years until the exigencies of programme planning and the demands of the technical sessions eroded away the time available for staging the contest during the period of the Conference. Thereafter the competition continued to be played at a special gathering held customarily in the Midlands during the summer. In recent years the participants in this competition have increased in number to between thirty and forty, and the number of prizes offered for competition has likewise increased, notably by the presentation of a silver cigarette case as the gift of Mr. Alan Jordan.

For three successive years the John Preston Trophy was won by Mr. R. G. Hughes, whereupon it became his outright property which he then put up again for perpetual competition.

The ninth competition for the John Preston Trophy and other prizes was held on May 30 this year at Moor Park Golf Course, and it attracted the largest entry so far recorded. In view of the fact that he was no longer the donor of the trophy, Mr. John Preston felt himself free to enter for the competition and marked the occasion by emerging the winner.

A party of some sixty competitors and their ladies sat down to dinner following the competition and applauded the winners of the many prizes which had been generously offered by a number of organizations.

Formation of New Golfing Society

The competitors for the John Preston Trophy had been drawn hitherto almost exclusively from the membership of the Institute of Metal Finishing, but on this occasion when a number of Open Competitions were included in the programme, members of the golfing section of the Finishing Luncheon Club and of the Metal Finishing Association, also took part. Discussions had taken place between Mr. Preston and members of the other two organizations and these resulted in an announcement being made during the course of the evening that plans were complete for the setting up of a Finishing Industry Golfing Society. This Society would be open to all golfers in the finishing industry, members of the Institute of Metal Finishing, the Metal Finishing Association, the Finishing Luncheon Club and kindred bodies being particularly welcome. Mr. Cyril Wharrad, chairman of the Midland Section of the M.F.A. who presided over the dinner, took the opportunity of mentioning that members of the new society would be very welcome at the match to be played between the I.M.F. and the M.F.A. in three weeks' time.

Anyone who is interested in obtaining further details of the Finishing Industry Golfing Society, who has not already submitted his name for membership is invited to communicate with either Mr. John Preston, John Preston and Co. Ltd., Sarsfield Road, Perivale, Greenford, Middlesex, or Mr. John Hooper, John Adam House, John Adam Street, Adelphi, London, W.C.2.

Aluminium Bronze install Dust Control Equipment

ALUMINIUM Bronze Co. Ltd. of Walsall have installed two Dallow Lambert size MG80 wet dedusters. Reasons prompting this selection were : the high rate of collective efficiency demonstrated at the manufacturer's works at Thurmaston, Leicester; the fact that their dust is from aluminium bronze and aluminium die-casting, which has explosive properties; and the resultant sludge emitted from the dedusters has a low water content and was acceptable to their waste product refiners.

The dedusters each have a capacity of 8,000 cu. ft. of air per min. and are self-contained with 30-h.p. motorized fans and drag-link sludge ejectors.

The sludge is discharged into two vertical hoppers located at the end of the building on which the dedusters are mounted and the quadrant gates at the base of the hoppers can be easily opened for disposal of the accumulated sludge.

To comply with requests from the Factory Inspectorate, weighted explosion doors are fitted to the outlet headers immediately prior to the fan inlets.

The design of this type of wet collector ensures that the hoods serving the polishing machines and grinders are served by a constant air flow and maintenance of an installaion of this type is reduced to a minimum.

TWO-DAY SYMPOSIUM ON ANODIZING OF ALUMINIUM

A CONFERENCE on the Anodizing of Aluminium, organized jointly by the Aluminium Development Association and the Department of Metallurgy, University of Nottingham, is to be held from September 12-14, 1961. This is planned as a two-day residential conference, and further details may be obtained from the Aluminium Development Association, 33 Grosvenor Street, London, W.1.

PAINT MANUFACTURERS SET UP JOINT EXECUTIVE COUNCIL

Mr. K. S. Flory Appointed Director

FOR many years the paint industry's interests have been looked after by the National Paint Federation and the Society of British Paint Manufacturers. Recently, to facilitate negotiations of the Industry's external affairs the Federation and the Society brought into being a body known as the Paint Manufacturers' Joint Executive Council. As its name implies, this Council has executive authority to deal with such matters without reference back to the two trade organizations. The latest major step in this chain of developments has been the appointment of a director of the Paint Manufacturers' Joint Executive Council.

An important outcome of this is that the industry now has an official spokesman operating from a central office, from which information regarding paints and allied surface coatings can be obtained. The Council has also inaugurated a Statistical Committee, the findings of which will be issued as they become available and as the occasion demands.

As a result of the director's appointment the United Kingdom paint industry is now represented on the European Committee of the Paint and Printing Ink Manufacturers' Associations. The first meeting at which the United Kingdom attended took place in Paris on April 24 and 25.

A further benefit of having an official spokesman is that the industry will be able to negotiate more easily with such bodies as Government Departments, the British Standards Institution and the Federation of British Industries, etc.

Another important aspect of the Council's work will be in connexion with staff recruitment and training for the industry. It has been felt for some time that due to developments taking place within the industry coupled with the demands from users for specialized finishes, the industry should be staffed with an even more adequate number of properly trained personnel.

This will mean that the British paint industry — the largest in Europe — will be able to keep ahead of technical developments in a world where the need for new and improved finishes is rapidly growing.

New Director

The new director of the Council is Mr. Keith S. Flory and in his appointment he is responsible for negotiating on behalf of the industry on external matters such as with Government Departments, the Federation of British Industries, and the European Committee of Paint and Printing Ink Manufacturers' Association.

Mr. Flory was educated at St. John's School, Leatherhead, and at Selwyn College, Cambridge, where he studied economics.

After leaving Cambridge he joined the Manchester company of Tootal Broadhurst Lee and in 1952 he joined Smith and Walton Ltd., paint manufacturers of Haltwistle, Northumberland; after five years with this company he became decorative sales director and export director of Sherwoods Paints Ltd., Barking, a company within the Donald Macpherson Group.

Since 1952, Mr. Flory has served on a number of Industrial Committees including the Building Paints Advisory Council.

In his new position he will now serve on the European Committee of Paint and Printing Ink Industries, the F.B.I. Grand Council, the F.B.I. Statistics Committee and a number of other committtees within the paint Manufacturers' Joint Executive Council.

Mr. Keith S. Flory

Mr. Flory, who is 45, served throughout the war in the Royal Air Force, initially as a navigator on operational flying duties and subsequently as a Staff Officer, Navigation and Bombing, at Combined Headquarters, Chatham. He was mentioned in despatches in the honours list published on January 1 1945.

INDUSTRIAL TRAINING COUNCIL SET UP REGIONAL COMMITTEES

THE Industrial Training Council has now established nine regional committees in England, and committees in Scotland and Wales, for the general purpose of keeping under review and, in consultation with appropriate organizations, of encouraging arrangements in their regions for the recruitment and training of young people during the "bulge" years.

The regional committees, which have been set up following the recently held I.T.C. regional conferences, are composed of representatives nominated by the British Employers' Confederation, the Trades Union Congress and the Nationalised Industries, and the secretariat for the committees is being provided by the regional offices of the Ministry of Labour.

The Chairman and Secretaries of the regional committees have met the Chairman of the Council, Mr. G. H. Lowthian, M.B.E., and other representatives of the Council to discuss the implementation of their terms of reference. In its work to date on the "bulge" the Council's main approach, working through employers' organizations and trade unions, has so far been industrial rather than regional. The regional committees will have to ensure as far as possible that their work does not conflict with what is already being done on an industry basis in their regions. The committees, like the Council, are advisory and it is envisaged that they will keep it informed of the various developments in their regions to deal with the "bulge" and be able if necessary to act as a link within the region between the local industrial organizations. In certain areas they may also be able to further the work of the Training Advisory Service of the Council both by advising as to fruitful sources of work and by publicizing the Service.

LARGE SHOTBLASTING CHAMBER COMPLETED

THE biggest hirework shotblasting chamber in Sheffield, which has been under construction for the past six months, has now been completed and brought into operation at the works of the Darnall Shotblasting Co. Ltd., Doctor Lane, Sheffield 9.

The steelwalled chamber, which is 32 ft. long by 12 ft. wide and 12 ft. high and has a 20 ft. square extension, is also among the largest in the country and has been equipped with the most modern blasting plant available.

The company say that this very large blasting chamber has been installed "because Sheffield is producing bigger and bigger fabrications and more and more do engineers want to have fabrications cleaned before they are painted with protective coatings." With this new equipment they will be able to undertake jobs of almost unlimited size.

Titanium Oxide to be Manufactured in Australia

LAPORTE Industries Ltd., announce the formation of the company, under the name of Laporte Titanium (Australia) Pty. Limited, which is to manufacture titanium oxide at Bunbury, Western Australia. The announcement that a £3½ m. (£A4 m.) plant was to be established at Bunbury was made in December. Mr. Robert I. Ainslie, Q.C., and Mr. Noel G. Humphries, have accepted invitations to join the board of the new company and Mr. Ainslie has been appointed chairman.

Mr. W. S. Duffield, managing director of Laporte Chemicals (Australia) Pty. Ltd., has been appointed a director of the new company, together with two members of the Laporte Industries Ltd., board in the U.K., Mr. Geoffrey Hickson and Mr. William Woodhall, managing directors of Laporte chemicals Ltd. and Laporte Titanium Ltd. respectively.

CIBA FELLOWSHIP AWARDS

AT a recent meeting of the Advisory Panel of the CIBA Fellowship Trust the following CIBA Fellowships were awarded :—

Mr. R. F. C. Claridge (University of Auckland and Cambridge University), for post-doctorial study at Cologne University (Radiochemistry); Dr. J. S. Littler (Oxford University), for post-doctorial study at the E.T.H. Zurich (Chemistry) ; Mr. H. Stern (Oxford University), for post-doctorial study at Brussels University (Theoretical Physics) ; Mr. F. I. B. Williams (McGill University and Oxford University), for post-doctorial study at Liege University (Solid State Physics).

Fellowships previously awarded to the following were renewed for a further year :—

Dr. V. P. Arya, at present working at Stockholm University (Natural Products Chemistry) ; Dr. W. D. Hamilton, at present working at Uppsala University (Nuclear Physics); Dr. R. Grinter, at present working at the E.T.H. Zurich (Physical Organic Chemistry) ; Dr. B. L. Mordike, at present working at Göttingen University (Physcial Metallurgy).

VENUS IN VITREOUS ENAMEL ?

ONE of the most outstanding exhibits at this years' Institute of Vitreous Enamellers' Conference and Fair at Harrogate was a new vitreous-enamel mural by Claude Prieur of Ferro Enamels Ltd., Womburn, Wolverhampton.

The mural measures some 8 feet 6¾ in. by 5 feet 10⅞ inches deep, is highly coloured, and is described as "Venus Arises."

The steel used in making the mural was of the cold-rolled, low-carbon type and the complete mural was made up of ten panels each of which was made into the form of a tray with 1-in. deep walls. The thickness of the steel used was 0.048 in., and the ground coats were sprayed, while the finishing coats were put on by brush.

An interesting feature is that some of the panels forming this mural were fired six or even eight times to fuse out the ground coat and various coloured coats thereafter. Despite this the panels have remained absolutely flat.

Minister of Science to Open International Plastics Exhibition

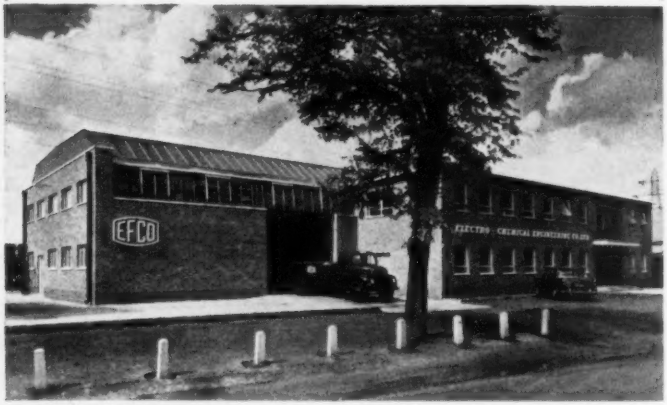
LORD Hailsham, the Minister for Science, is to open INTERPLAS 61 at Olympia, London, at 12 noon on Wednesday, June 21. After the opening ceremony the Minister will make a tour of the exhibition.

INTERPLAS 61, the sixth International Plastics Exhibition and Convention, takes place from June 21 to July 1. It is organized for British Plastics and International Plastics Engineering by Iliffe Exhibitions Ltd. with the co-operation of the British Plastics Federation.

VINYL ACETATE PLANT EXTENSION

HEDON Chemicals Ltd., have recently completed substantial extensions to their vinyl acetate plant at Salt End near Hull. The plant is situated on the 100-acre site owned by The Distillers Co. Ltd., Chemical Division. Hedon Chemicals is jointly owned by D.C.L. and Shawinigan Chemicals Ltd. of Canada. The vinyl acetate plant was initially commissioned in September 1956 and the recent expansion will increase the original productive capacity by approximately 60 per cent.

NEW EFCO DEPOT FOR MIDLANDS



GREATLY improved services and supplies for plating shops and trade platers are ensured in the Midlands by the opening of the £50,000 depot of the Electro-Chemical Engineering Co. Ltd., Moor Lane, Witton, Birmingham 6, on a two-acre site adjacent to the projected route for the highway linking the Bristol and Preston motorways. The site has been developed on the most modern lines, the design allowing for speedy expansion of sales offices and stores. In addition, an extensive laboratory will provide customers with testing and analytical services similar to those available at the company's headquarters in Sheerwater, Woking, Surrey, and the new depot serves as a base for qualified service chemists and engineers who are available at short notice for Midland customers. The company's turnover has increased considerably in the last five years and these new premises, under the management of Mr. L. S. Lowery, Midland area sales manager, and Mr. R. Spedding, depot manager, can be expected to be of major importance in further growth.

TITANIUM BASKETS FOR NICKEL PLATING

A REPORT from America states that in the nickel-plating industry 10 to 20 per cent of each nickel anode used in plating is scrapped and sold for a price considerably below that of the new anode. It is claimed, however, that titanium scrap saver baskets provide a reliable method of reclaiming nickel scrap and eliminate any scrap loss.

Titanium metal has unusual electrochemical properties, being capable of passing current to metal in contact with it (in this case nickel scrap), but it will not pass current to the bath. No other metal of comparable price has this quality. High quality plating is possible because the titanium baskets are as efficient as the regular anodes, and the baskets do not corrode or require maintenance.

The expected life of a basket of this type is 10 years under normal working conditions. It will withstand corrosion in any type of nickel bath, with the exception of sulphamate and fluoborate baths.

These baskets are marketed in Canada by Atlas Titanium Ltd.

FERRO PURCHASE FRENCH COMPANY

FERRO Corporation, parent company of Ferro Enamels Ltd., of Wombourn, Wolverhampton, has acquired full ownership of its French affiliate in Paris, Procédés Ferro. The acquisition was announced recently by Ferro's President, Mr. H. T. Marks, who said that "Full ownership of Procédés Ferro has been acquired in order to facilitate the integration and expansion of Ferro's operations in the growing European Common Market. As a full partner in our world-wide family, the French company will provide us with a second operation in this growing Market. Together with our Dutch company, it will enable us to provide more flexible and complete service to our European customers."

Procédés Ferro for 30 years has manufactured porcelain enamel and ceramic glaze frits, inorganic colours, and has designed and built enamelling and ceramic plants. Georges de Surmont will remain general manager of the company.

New Aluminium Alloy and Chrome Plating Process for Car Bumpers

THE Metallurgical Research Department of the Kaiser Aluminium and Chemical Corporation in the United States has recently developed a new series of heat treatable aluminium alloys and a chrome plating process especially for car bumpers. The two metallurgical advantages will help to bring about the early use of aluminium bumpers, and will permit manufacturers to produce bumpers at costs competitive with steel which meets the motor industry's requirements for finish, corrosion resistance, and strength. Car manufacturers are interested in bumpers which will reduce weight loads at the front and rear extremities of the vehicle where they adversely affect ride performance. With aluminium this weight can be reduced from between 50 to 60 per cent.

The new alloys have high strength and good ductility for forming. With this combination of characteristics, bumpers can be made from aluminium sheet of approximately the same thickness as steel models.

The company has applied for patents on the new process used for plating aluminium with a duplex nickel-chrome finish. Accelerated laboratory and service tests indicate that aluminium plated by this process has superior resistance to the corrosive action of road splash and will maintain its brightness.

Full scale prototypes of the new bumpers have been plated on a pilot line by The Electric Autolite Company, at Sharonville, Ohio, under a joint programme with Kaiser to develop production methods.

Water Pollution Research in 1960

THE Water Pollution Research Board, in their annual report conclude that the matters of greatest importance for the programme of research of the laboratory at the present time are the study of the effects of polluting substances in streams and the investigation and improvement of the basic processes common to the treatment of sewage and of many industrial wastes. These basic processes include sedimentation of suspended solids, the dewatering of the resulting sludge, and the treatment of the liquid portion of the waste by biological methods ; consequently these lines of research now take up a large proportion of the resources of the laboratory.

"Water Pollution Research 1960," is published for D.S.I.R. by H.M.S.O. price 7s. 0d., by post 7s 7d.

IN MEMORIAM

Professor Heinz Bablik

Professor Heinz Bablik

PROF. Heinz Bablik was born in Vienna on April 23, 1900. Having graduated from the Technical High School in Vienna, he studied chemistry at the Polytechnic there and obtained his degree in 1923.

In consideration of his scientific work on corrosion prevention he was called to the Chair a few years later and in 1938 was appointed Professor extraordinary at the Vienna Polytechnic.

In 1926 Prof. Bablik and his elder brother Dr. Hans Bablik (who died in 1957) founded the Brunner Verzinkerei (Galvanizing Works) Brüder Bablik. The present importance of this firm is due to the untiring activity of the two brothers who were able to organize a business which constantly developed and operated on the most modern technical principles.

Especially in the field of practical applications and automation Bablik's work set an example for many other companies all over the world, and many specialists in every country received valuable advice from him. All who called at the Brunner Verzinkerei were impressed by the great value of his work.

Prof. Bablik was considered in the galvanizing field as a man of international fame and his book "Hot Galvanizing," published in many editions and languages, is considered as a fundamental work in this field. Many articles, reports and test results on hot galvanizing appeared over his signature in nearly all technical reviews of the world.

In recognition of his great scientific gifts in the field of corrosion prevention he was appointed in 1956 Chairman of the European General Galvanizer's Association, an office he held with enthusiasm and authority.

On January 14, 1961, Prof. Bablik died in Bombay, from a heart attack, during a business trip.

Research and collaboration have always been the pillars of all Prof. Bablik's work, and a few months before his death he had crowned his own work by installing in his factory a new steel strip galvanizing plant.

Prof. Bablik's wise counsel will be greatly missed by his many friends in industry throughout the world.

NEW COMPANIES

"Ltd" is understood, also "Private Co."

Figures = Capital, Names = Directors, all unless otherwise indicated.

P.& H. Stainless Steel (Polishing), Rear 32 St. Marys Row, Moseley, Birmingham. April 10. £1,000. Walter J. Hewitt, Edward C. Dovey.

H. D. Simpson and Company (Polishers), 28 Island Road, Handsworth, Birmingham. April 13. £600. To carry on business of metal polishers, etc. Harold D. Simpson, Mrs. Joan B. Simpson.

J. R. Chambers, Finsbury Circus House, Blomfield Street, London, E.C.2. April 19. £5,000. To carry on business of importers and exporters of and dealers in chemicals, plastics, metals, etc. Jas. R. Chambers, Bernard R. Chambers.

S. A. Watts, 781 Hertford Road, Enfield, Middlesex. May 2. £1,000 To carry on business of metal polishers, painters, etc. Sydney A. Watts Margaret G. K. Watts.

From the Register compiled by Jordan & Sons Ltd., 16 Chancery Lane, London, W.C.2.

VICTORY FOR A FINISH

A VULCAN finish, manufactured by the Industrial Division of paint manufacturers Blundell, Spence & Co. Ltd., was used on the Panorama coach with which Sheffield United Tours Ltd. won the Clacton Trophy for the most marks in the Concours d'Elegance at the 1961 British Coach Rally at Brighton. Among other award winners whose vehicles had Vulcan finishes were Liss and District Coaches Ltd. and Creamline Coaches Ltd. of Bordon, Hants.

TECHNICAL *and* INDUSTRIAL APPOINTMENTS

The **Cambridge Instrument Co. Ltd.,** announce the appointment of Mr. K. J. Bush, A.M.I.E.E., as assistant sales manager, Mechanical Thermometer Division, Friern Park, N. Finchley.

The appointments are also announced of Mr. W. C. Orford, Mr. S. V. J. Crump and Mr. W. A. Hall as assistant resident engineers at the company's branch offices in Nottingham, Bristol and Manchester respectively.

* * *

The chairman and Managing director of **Juno Engineering Ltd.,** Alderman Norman Harris, B.Sc., J.P., has been appointed Mayor of the County Borough of Southend-on-Sea.

At the same time the appointment is announced of Mr. E. G. Marshall as works manager, Plating Division.

* * *

Mr. A. A. Jupe has joined the Industrial Division of **Blundell, Spence and Co. Ltd.,** paint manufacturers, as an industrial finishes representative for south-east London, Kent, Surrey and Sussex.

Mr. Jupe has several years' test shop experience of transport and industrial finishes including wood finishes.

* * *

The following appointments to the board of the **Consolidated Pneumatic Tool Co. Ltd.,** are announced: Mr. S. H. Ireland, assistant managing director, Mr. L. S. Bright, financial director, Mr. O. A. Miller, director.

Mr. Ireland joined Consolidated Pneumatic in February 1960 and shortly afterwards spent several months in South Africa on the reorganization of the Company's branch at Johannesburg.

Mr. Bright has been in the company's service since 1944 and was appointed secretary in 1953, and Mr. Miller is a partner in the law firm of White and Case.

* * *

Mr. F. Murphy has recently joined **Metal and Pipeline Endurance Ltd.,** as a senior cathodic protection engineer. His principal activities will be in connexion with the various pipeline cathodic protection projects being carried out by MAPEL. Prior to joining this company Mr. Murphy was technical director of Metal Economics (Seaguard) Ltd., and was also at one time corrosion engineer for Shell in Venezuela.

Laporte Industries Ltd. announce that Mr. G. F. Sommerville, manager of the Baronet Works, Warrington, of Laporte Chemicals Ltd., has been appointed a director of that company.

Mr. Sommerville joined the company in 1957 in connexion with the commissioning of the organic chemical process for the manufacture of hydrogen peroxide.

After experience at the pilot plant at Luton, he became manager of the new plant at Warrington and in November 1959 was appointed works manager there in succession to Mr. C. B. Bolland.

* * *

Mr. H. A. Slade, B.Sc., A.R.I.C. (chief chemist) has been co-opted on to the board of directors of **Detel Products Ltd.**

* * *

Mr. S. A. Ryall has been appointed advertising manager of **Black and Decker,** Harmondsworth. Mr. Ryall was previously advertising manager with R. Gay and Co., manufacturers of Gaymel paints.

PLASTICS INDUSTRY CONTINUES EXPANSION

THERE are signs that the plastics industry is once again moving into top gear. Although 1960 returns showed that production at 560,000 tons was only 12 per cent. above the previous year's output, and consumption within the U.K. at 20 per cent. up, these figures by comparison with gains shown in preceding years were construed as a mild recession for the industry. Part of the reason for this slight falling off in the rate of expansion was due to the recessions in consumer durables, notably motor cars, refrigerators, T.V. sets and domestic equipment. Recovery in some of these markets is already noticeable and many sectors of the plastics industry are becoming very active.

Imports of plastics materials, a major factor in the market in 1959, have already shown a fall of 13 per cent. over the first three months of the year.

Exports have increased by 12 per cent. according to the returns for the first quarter. At a level of 200,000 tons per year, valued at £45 million, plastics materials are maintaining their position in the export market.

DSIR STEPS UP CHEMICAL RESEARCH

"INASMUCH as the chemical industry of the country continues to expand, the need for research in the chemical field by the Government will inevitably grow," says the Steering Committee of the National Chemical Laboratory of the Department of Scientific and Industrial Research in their annual report. The Committee therefore recommends to the Council for Scientific and Industrial Research that the staff of the laboratory should be increased by roughly one-half in the next 5-7 years and doubled in the next 10-15 years.

Existing accommodation at Teddington is inadequate for this expansion and proposals for either building extensions or a new site are under consideration.

The current research programme is still being developed, and some material changes were made in the work of several research groups during the year. For example, the conversion of the former work on physico-chemical properties into a more comprehensive programme of chemical thermodynamics has continued ; work on hydrometallurgy is being extended to include some fundamental work on the more familiar metals of industry; and staff formerly employed on the extreme purification of semi-conductor materials are turning their attention to uses for the very substantial quantities of rare earth elements now becoming available.

The report of the National Chemical Laboratory 1960 is published for D.S.I.R. by H.M.S.O., price 4s. 6d. net, 4s. 11d. by post.

ETHYLENE DICHLORIDE

BRITISH Hydrocarbon Chemicals Ltd's large plant at Grangemouth for the manufacture of ethylene dichloride (1 : 2 dichlorethane) will come into production in July/August 1961. Commercial enquiries should be addressed to the selling agents, The Chemical Division of The Distillers Company Limited, Devonshire House, Piccadilly, London, W.1. or to their regional sales offices.

The bulk of the production of ethylene dichloride will be shipped to the Distillers Plastics Group factory at Barry, South Wales, where it will be used for the manufacture of vinyl chloride and hence PVC.

Ethylene dichloride has many solvent applications in paint remover formulations, rubber cements, extraction of vegetable oils and metal degreasing.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Dry Honer

ALL manufactured articles require some form of surface finish. It may consist of either a protective or decorative coating, or even an effect imparted to the material itself. If, therefore, these two basic needs can be covered by a single operation, very considerable savings accrue. The Vacu-Blast dry honer (Fig. 1) offers, in effect, these and other facilities.

The dry feeding of fine cleaning media, sometimes as fine as 600 mesh, has always presented certain problems, as the particles tend to 'pack.' This tendency has been overcome in the past by the use of liquids as propellents, and while liquid or 'slurry' honing is an established practice in many processes, the possibility of dry feeding equally fine cleaning media using compressed air only as the carrier, presents many advantages. The dry honer, by means of feed aeration, is claimed to have finally eliminated the necessity for wet or slurry honing.

As might be expected, the variations and types of surface finish available are infinite. The dry honer is by no means restricted to the use of the finer abrasives and is equally well suited to imparting a coarse etch on small components where, for instance, rubber or other types of bonding are to be carried out. At the other end of the scale, the equipment is used to remove deposits and accumulations from aircraft turbine blades as well as from rubber seal moulds. The high degree of surface finish obtained is illustrated by the rubber moulds cleaned (Fig. 2) where the original machining marks were once again visible yet no detectable difference took place in the mould contour.

Where a fine matt finish is required, as for example for plating, it is of equal importance to ensure that the surface is uniform. This can only be achieved by retaining the particle size of the cleaning media. In the dry honer, all particles below the required mesh size are continuously extracted and carried over by cyclonic action, together with any deposits removed from the workpiece, to the dust section of the machine. By this action, a uniformity of surface is ensured, and rejects, after perhaps costly after-processing, reduced if not entirely eliminated.

There are no installation costs and, being an entirely dry process, no drying or waste disposal plant is required. The dry honer may be used anywhere where there is a supply of compressed air (35 cu. ft. per min.) and electricity (400/440 v.). Moreover, the cabinet may be castor-mounted, and made to serve several shops.

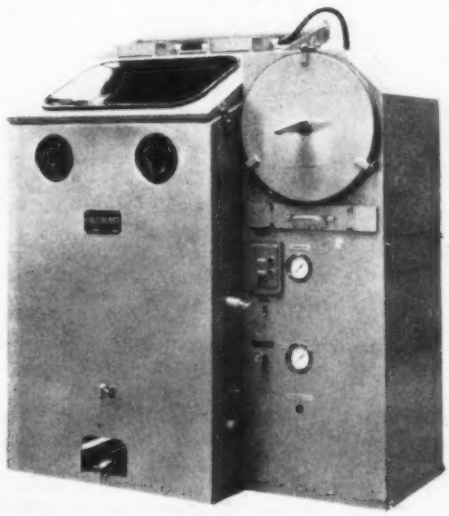
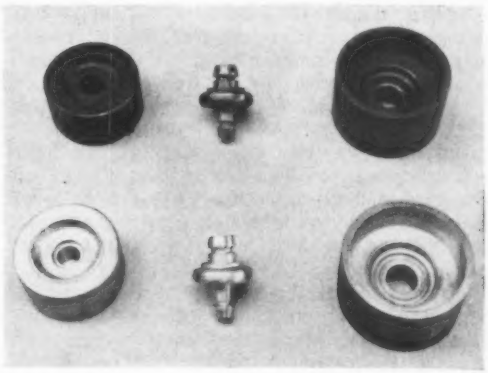


Fig. 1 (left).—Dry honer.

Fig. 2 (below).—Moulds cleaned by dry honer.



The equipment is available in three sizes giving internal working dimensions of 23 in. x 23 in., 27 in. x 27 in. and 30 in. x 36 in. ; in the two larger cabinets provision is made for the side-loading of components, and extended runways to further facilitate loading may be provided.

Available from Vavu-Blast Ltd., 10, Wellcroft Road, Slough, Bucks.

Scrapers

HARD metal scrapers have been used for many years but it is only recently that scrapers with inserted easily-replaceable ends have been introduced.

After considerable and extensive tests, Prolite Ltd., Rainham, Essex are marketing the 'Prolite' inserted blade scraper which is claimed to save both time and money because it requires less servicing owing to the use of 'Prolite' hard metal as the cutting tip.

Each scraper holder will accommodate blades 1 in. 1¼ in. or 1½ in. wide, all of which can be delivered ex stock.

When it becomes necessary to resharpen the scrapers, the same methods should be used as applied to the regrinding of the standard range of 'Prolite' cutting tools but it is recommended that for light resharpening a diamond grinding wheel only be used. Further information can be obtained from Central House, Upper Woburn Place, W.C.1. Guildhall Buildings, Navigation Street, Birmingham, 2. Norwich Union Buildings, City Square, Leeds 1.

Magnetic Thickness Gauge

THE "Mikrotest" magnetic thickness gauge is available from The Acru Electric Tool Mfg. Co. Ltd., Demmings Road, Councillor Lane, Cheadle, Cheshire.

The gauge (Fig. 3) is a hand-instrument for measuring the thickness of protective surfaces on steel bases, *e.g.* enamel, galvanized coatings, etc. It utilizes the attraction of a permanent magnet through the layer to be measured, which depends on the thickness of this layer. This instrument requires no electrical power source.

Its housing contains a rod-shaped permanent magnet of high-grade ALNI alloy, mounted on the end of a perfectly balanced rotating arm so that a semi-spherical, polished pole is just visible. A measuring dial which can be turned by the index finger is coupled to the rotating arm over a spring. The dial is subdivided to indicate the thickness of the layer.

For measuring, the instrument is placed on the specimen to be measured with its pole resting on the surface, after measuring dial has been adjusted to maximum thickness. The magnet

Fig. 3.—Magnetic thickness gauge.

resting on the non-magnetic surface is attracted by the ferro-magnetic base. By turning the measuring dial the spring is strained until the magnetic contact breaks and recoils into the housing. The accurate surface thickness can then be read on the measuring dial.

Since the system of the Mikrotest is accurately balanced, surfaces can be tested in any position, which is of considerable importance with perpendicular walls of containers etc.

In the case of nickel surfaces on steel, only relative measuring is possible, since nickel is not absolutely non-magnetic.

Universal Lubrication System

CASTROL Industrial Ltd., announce the development of a two-line centralized lubrication system suitable for either oil or grease. Known as the Universal Centralized Lubrication System, it is based on a new positive dispensing unit.

Dispensing units, which can be made up into assemblies having from 2 to 8 outlets, can be arranged for any desired combination of parallel and progressive operation. Advantage can thus be taken of the best features of both arrangements by connecting the units progressively for main lubrication points and in parallel for secondary points.

For large installations, power-operated pumps are proposed and for smaller installations, where continuous lubrication is not required, hand-operated pumps are provided. The amount of lubricant discharged from each unit can be adjusted as required. Also available are timers, starters and control and warning equipment.

Full details of the new equipment are contained in an illustrated booklet "Universal Centralized Lubrication Systems" which can be obtained from the Engineering Division, Castrol Industrial Ltd., Castrol House, Marylebone Road, London, N.W.1.

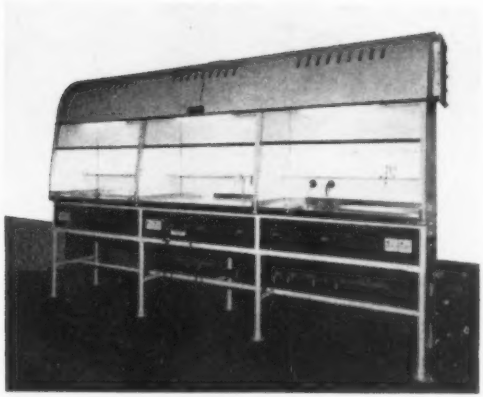


Fig. 4.—Fume cabinet.

Fume Cabinets

TURNER and Brown Ltd., Davenport Works, Davenport Street, Bolton, are now producing a range of "Turbro" fume cabinets for use in universities, hospitals, laboratories, and industrial processing.

Fig. 4 shows a 3-module unit constructed from P.V.C. resin-bonded blockboard, completely sealed. " Turbro " fume cabinets have " built in " fume extraction, stainless-steel interchangeable sink units and working surfaces, fume-proof fluorescent light fittings, "twin" position glass-clear P.V.C. sliding sashes and front-controlled services.

Special features of the 1, 2 and 3 module cabinets are a tubular steel polythene-coated under bench unit with adjustable legs, which can incorporate standard timber cupboards or shelf units.

An emergency shower is fitted to the front control panel for use in case of acid splashes, and in the front control panel are flush-type 13-amp. power points with indicator lights and flush-mounted push-button fan starter.

Floor Treatment Compound and Water-wash Additive

A MINERAL compound capable of absorbing many times more than its own volume of oil, grease and other liquids is now being marketed by Metal Pretreatments Ltd., 240 Clapham Road, London, S.W.9. Claimed to be sixteen times more absorbent than sawdust, Dri-A-Dex does not soften when saturated with oil, but remains granular and provides a safe, non-slip surface even when laid down in pools of oil. It is insoluble, and non-inflammable. Scattered onto oily surfaces the product not only absorbs the loose oil on the surface, but will soak up contamination from concrete, and can therefore be looked upon as a floor cleaner as well as a means of providing a safe, non-slip, non-inflammable carpet. Dri-A-Dex also absorbs odours—and can be recommended for use in machine shops, printing shops, chemical works, oil refineries, and anywhere where oil, grease or any liquids present a hazard to safety.

Also developed by Metal Pretreatments Ltd., is " Wat-A-Flo " additive for water-wash spray booths. The makers say that, when added to the water reservoir in water-wash spray booths Wat-A-Flo destroys paint residues and ensures a complete water curtain at the back of the booth, by preventing paint mediums settling and breaking the curtain. Clogging of pumps and water jets by paint is also prevented, since it destroys the adhesive properties of paint carried into the reservoir by the water curtain.

Safe and effective for all types of paint, the compound, added at the rate of half oz. per gal. is claimed to be more effective than double the quantity of other products. The amount of frothing produced by similar products has been a constant cause of complaint in the past. Careful formulation has ensured that Wat-A-Flo produces minimum frothing, and tests have proved its superiority in this respect.

Hammer Finish Stoving Enamel

BRYCE Weir Ltd., Brylex Works, Watford, Herts., have produced a hammer-finish stoving enamel, Brysolex Stovespeed, which has the remarkably short stoving time of 10 minutes at 240° F. in a convection oven, thus saving time and fuel, and enabling production to be speeded up by as much as 50 per cent without capital improvements.

These hammer finishes (available in a range of dual tones) are spray applied with standard spray-gun equipment. Their resistance to sagging on vertical surfaces is claimed to be good and makes application easy, giving hammer finishes which hide any minor metal imperfections and provide in one coat a smooth, non-dust collecting surface.

The finishes can be air-dried by the use of a catalyst. This is supplied separately and mixed in the proportion of 20 parts Brysolex Stovespeed to one part catalyst just prior to use. The air-dry and stoved hammer finishes match closely in pattern providing the application technique is kept the same. When catalyzed these finishes become touch-dry in one hour and ultimately approximate to the degree of hardness of a stoved finish. Certain shades of gold are not available for drying in this way. By this method " touching up " of stoved equipment without re-stoving may be carried out and also a hammer finish may be applied on equipment which cannot be stoved.

Normally Brysolex Stovespeed hammer finishes are used as a one-coat system, but where a primer is required to give extra protection, or where the surface of the material is poor, Weirs tinted etch primer is suitable giving an overall stoving time of only 20 minutes.

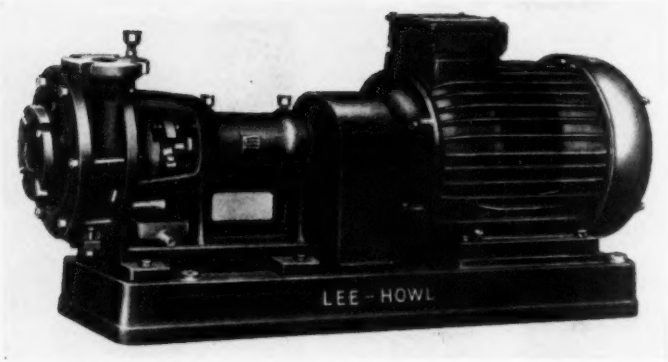


Fig. 5.—Chemical pump.

Chemical Pump in Silicon Iron

THE new 2-in./2½-in. 'Hypersilid' chemical pump (Fig. 5) recently produced by Lee, Howl and Co. Ltd., Tipton, Staffs, has an unusually wide range of applications—particularly in the chemical industry—but also in many other process industries owing to its advanced design and corrosion resistant properties.

The pump is made from silicon-iron castings manufactured by Bradley and Foster Ltd. It is designed for the handling of such corrosive liquors as sulphuric acid at any temperature or concentration, nitric, acetic, formic, phosphoric acids and many others.

The outputs are : 153 ft. head—75 gal. per min. maximum ; 80 ft. head—187 gal. per min. with maximum impeller diameter ; 86 ft. head—65 gal. per min. maximum ; 51 ft. head—150 gal. per min. with minimum impeller diameter. The speed is 2,900 r.p.m.

No wear rings are fitted, the impeller running clearance being generous, thereby avoiding rapid loss in pumping efficiency from wear and corrosion. The various parts in contact with the acid are made of silicon iron, while other parts are of best quality fine-grain grey iron castings. The pump shaft is made of Staybrite steel, adequately protected against liquid drippings by a high-silicon-iron wearing sleeve extending through the whole depth of the stuffing box.

The impeller and shaft assembly can be quickly removed as a unit through the pump casing, without disturbing any of the bearings and other components. Two widely spaced ball and roller bearings are fitted in the substantial cast-iron headstock. The casing is of the volute type, made from high-silicon iron, of ample wall thickness to allow for design pressure under corrosive conditions, and is provided with a drain plug.

The pump can be fitted with a suitable soft gland packing or with a mechanical seal, both types readily interchangeable. In the case of soft gland packing, the gland and gland bush are of the split type, easily removable. The stuffing box is made of plastic material and a Stauffer type lubricator provides the necessary lubricant. In the case of a mechanical seal, according to duty and requirements, the detachable stuffing box, gland and lantern ring are replaced by a simple clamping plate.

The volute casing and suction cover are tested up to 100 lb. per sq. in. The drive can be by motor on a common baseplate or by V-belt.

Nickel Plating Solution

THE new nickel solution 296 developed by W. Canning and Co. Ltd., Great Hampton Street, Birmingham 18, has been specially formulated to give a deposit which combines high corrosion resistance with maximum levelling. The 296 deposit can be used either as an undercoat for duplex nickel or as a single nickel coating prior to chrome. The deposit, it is claimed, has particularly high resistance to corrosion by industrial atmospheres. A further claimed property of the coating is that the proportion of highly corrosion-resistant nickel in a duplex coating can be covered from 60 to 80 per cent. without loss of brightness or surface levelling. In addition the 296 solution is compatible with both B.Q. 840 and B.Q. super bright nickel solutions and there is no danger of laminated deposits being formed. From the 296 solution components can be transferred directly, without rinsing or "striking" into either of the two above solutions to obtain a fully bright levelled deposit. The solution is simple to operate and maintain, a single addition agent being provided to maintain the levelling properties of the solution. This addition agent is readily soluble in warm water and its concentration in the plating solution can be determined by chemical analysis. The addition agent concentration is not critical.

The usual operating current density is 35 to 45 amp. per sq. ft. but up to 60 amp. per sq. ft. can be used.

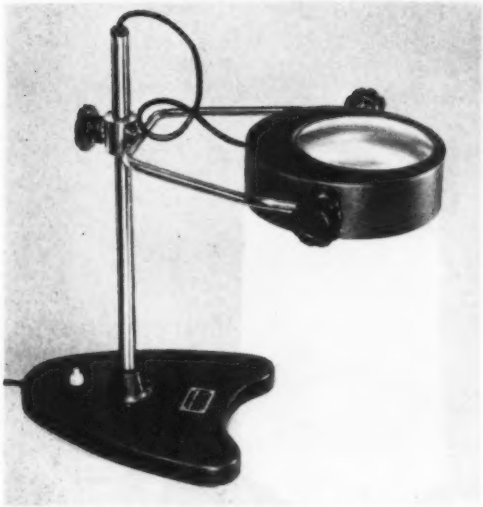


Fig. 6. Bench illuminator magnifier.

Bench Illuminator Magnifier

THE "Ellisviewer" bench illuminator magnifier (Fig. 6) has a "hood" which houses two light bulbs, an optically worked glass lens of 5 in. dia. and a magnification of 2½ times. It is adjustable on the main stand for height and correct focus, and may also be tilted to any angle, thus affording perfect vision angle and steady illumination of the spot to be examined. Although this magnifier can be used for the examination of isolated articles it is particularly suited to repetitive examination. The makers are the Ellis Optical Co., Mayday Road, Thornton Heath, Surrey.

Metal Phosphating Process

THE Hellerman Phosphate Protection Division who claim to be the first to introduce combined immersion, degreasing and phosphating processes giving a conventional zinc phosphating coating with also a wide range of coating weights, have now produced a new spray phosphating process—"Fospray."

Conventional spray techniques have the disadvantages that the steel to be treated must be perfectly degreased before phosphating, and the treatment tunnel needs to be very long. By using the new "Fospray" process, the necessity for degreasing prior to spraying is completely eliminated. So is the need for a very long tunnel.

Because of the simplification of this process, the usual heavy cost of plant installation needed for spray phosphating will be found to be drastically reduced.

Further information is available from Hellerman Ltd., Bowthorpe Electric Company Limited. Crawley, Sussex.

Announced by the same company is Hellermann CRC 2.26 a simple but effective anti-corrosion and anti-moisture treatment for electrical and electronic equipment, which is claimed to have the ability of penetrating pores, cracks or holes and displacing absorbed moisture. After driving the moisture out, CRC 2.26 forms a film to prevent further contamination. This film does not become brittle or crack and is an excellent corrosion inhibitor for metallic surfaces. CRC 2.26 also has a beneficial lubricating effect on moving parts and can also be used to restore to operation equipment that has been damaged by excessive exposure to moisture or by total immersion.

The material is supplied in a 16 oz. aerosol dispenser and can be used on the production line and takes up very little room in a tool kit. It is also available in 1 and 5-gal. cans and 55-gal. drums for brushing and immersion.

Hylumina in Difficult Shapes

DEVELOPMENT of new techniques and manufacturing methods is reflected in an ever-growing range of components for which Hylumina, with its remarkable qualities of great strength and resistance to extremely high temperatures, is ideally suitable. The production in ceramic of many components has become possible solely as a result of an almost dramatic advance in manufacturing methods—an advance which is claimed to have solved problems for many industries.

In the field of atomic engineering Hylumina is used for the manufacture of thermal discs which have been supplied for use inside nuclear reactors to insulate the uranium fuel element from the ends of the magnesium can. A material with a suitable neutron absorption is necessary under such conditions, hence its use also for a variety of support jigs and test pieces against which the susceptibility of other materials to irradiation can be measured. The stability of Hylumina at high temperature and under irradiation has led to its use outside the reactor in many applications, such as in lead-through terminals for heat exchange pressure vessels.

Among the interesting shapes in Hylumina for the first time are cathode supports and an externally threaded nozzle used in slag separation at power stations, and ceramic components include nozzles for shotblasting, thread guides for the textile industry, wire guides and pulleys. Igniters for oil burners and probes for depth and flame control are further examples of components using the exceptional properties of this material.

Available from K.L.G. Sparking Plugs Ltd. Putney Vale, London, S.W.15.

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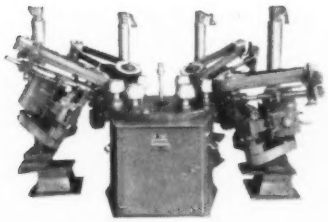
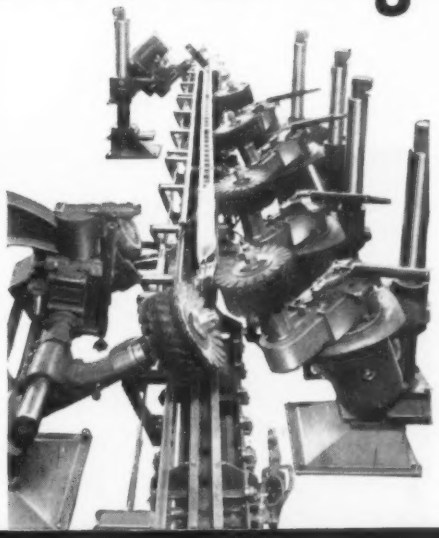
Automatic Polishing and Buffing





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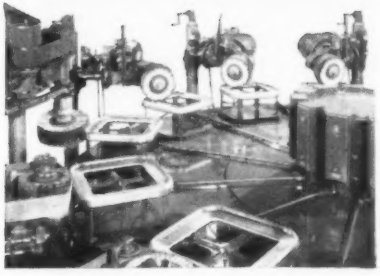

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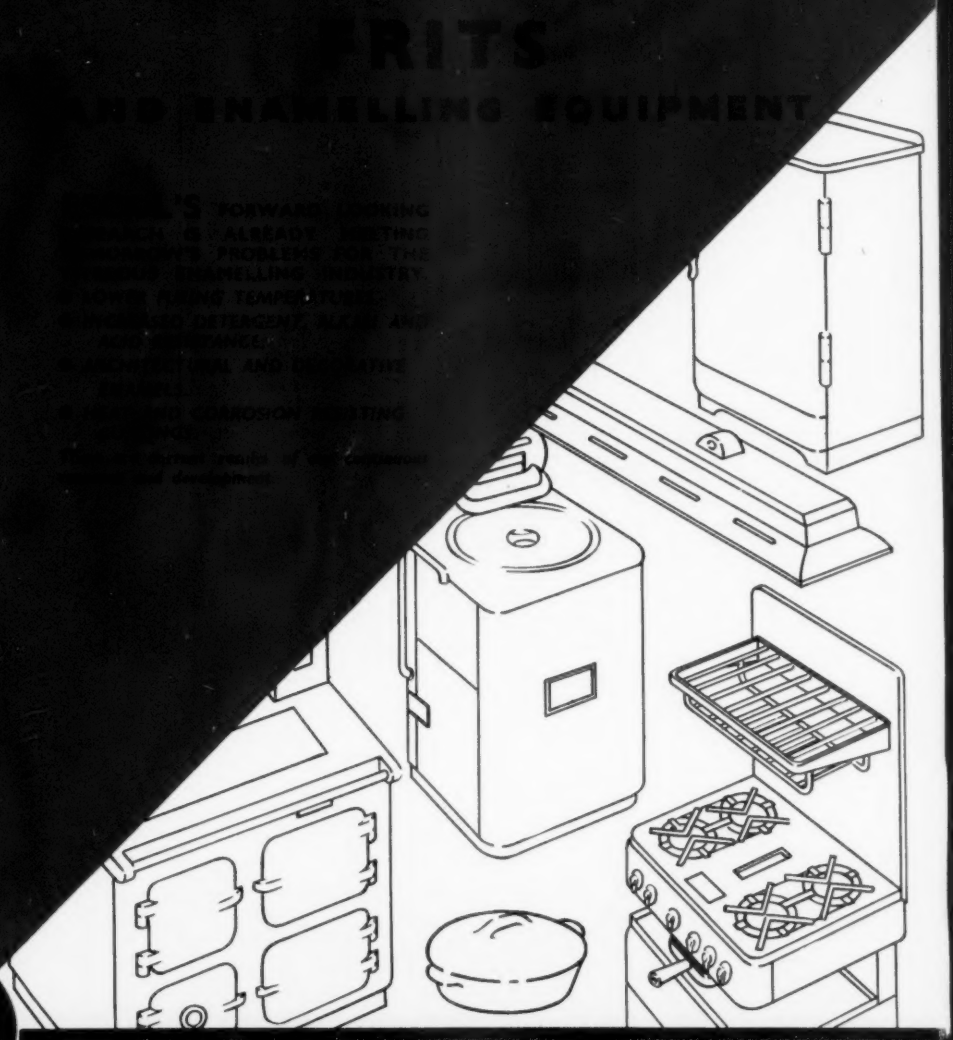

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